SCIENTIFIC AMERICAN

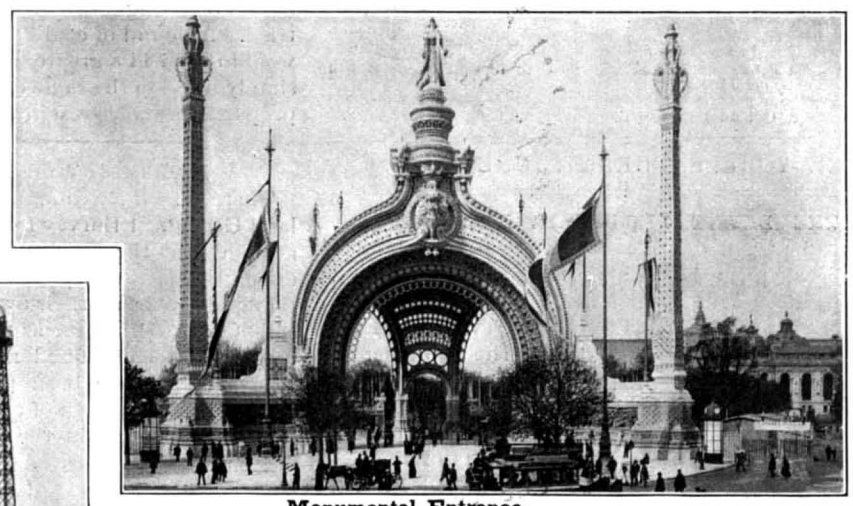
[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1900, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXXII.—No. 26. ESTABLISHED 1845. NEW YORK, JUNE 30, 1900. $3.00 A YEAR. WEEKLY.



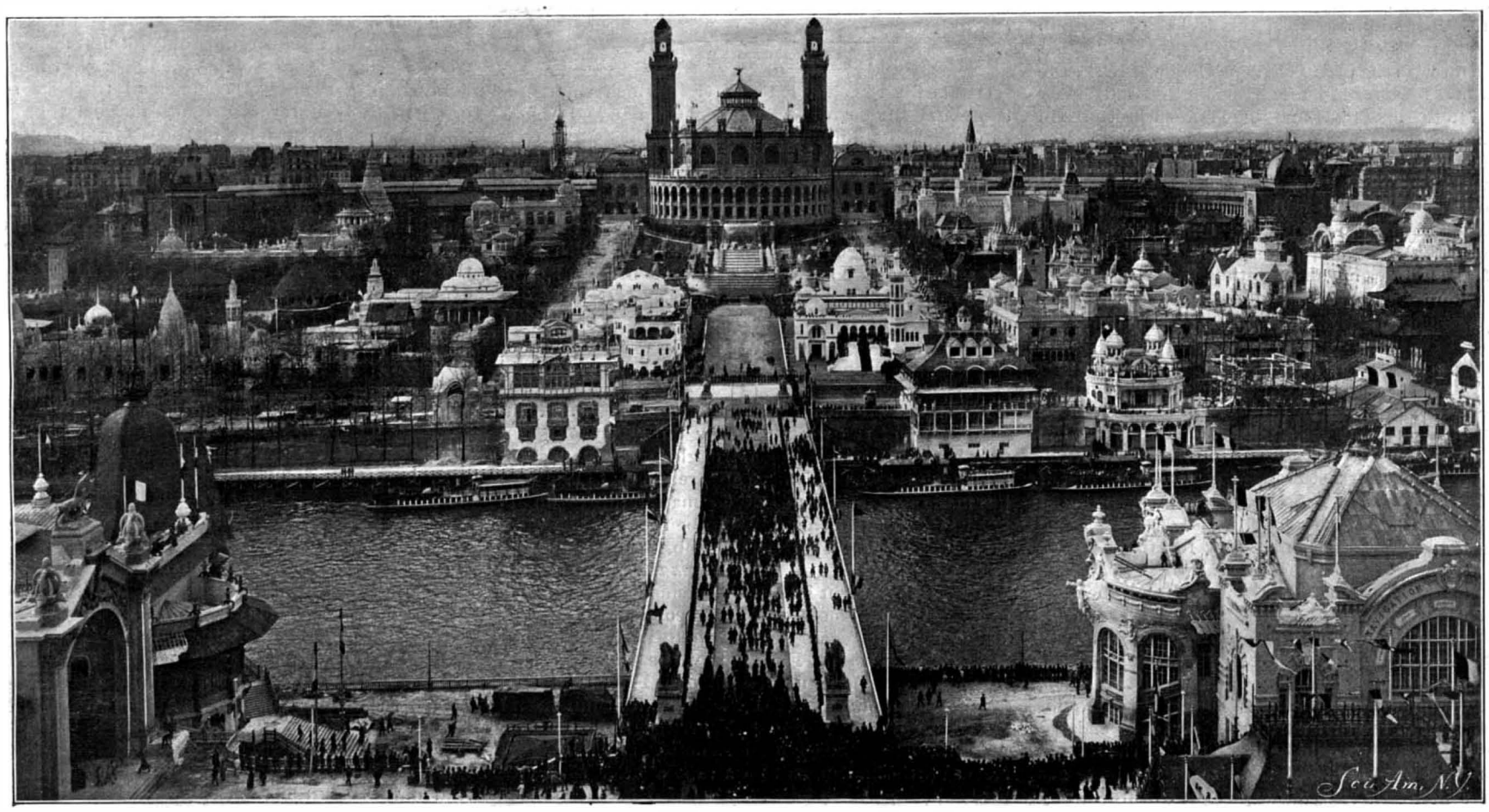
Champ de Mars Section During the Inauguration.



Monumental Entrance.



General View of the Champ de Mars Section from the Trocadero.



The Trocadero Section from the Champ de Mars.

SOME PERSPECTIVES OF THE PARIS EXPOSITION.—[See page 406.]

Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year.
Scientific American Supplement (Established 1876) 5.00 "
Scientific American Building Edition (Established 1885). 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, JUNE 30, 1900.

THE LATEST LIQUID AIR FALLACY.

Our readers will doubtless remember that about a year ago, when the liquid air craze was at its height, we published (SCIENTIFIC AMERICAN, April 22, 1899) a characteristic article from the pen of President Morton, of the Stevens Institute, exposing the fundamental fallacies underlying the claims which were being made for liquid air. This and other *exposés* that appeared in the contemporary technical press of the country went far to neutralize the pernicious effects of the liquid air promotion that was then rampant. After a period of comparative quiet, the public is again deluged with prospectus literature of the kind that is unfortunately only too successful in emptying the purse of the half-informed and all-too-easily-deluded investor.

The present exploitation, however, is being carried out under a new name, and with promises of profit that are as alluring as the most exacting prospectus-writer could demand. Liquid air no longer parades as a perennial source of motive power whose volume, so far from diminishing, grows larger the more we take from it; and as representing an inexhaustible source of refrigeration it has evidently lost its drawing power. We are now told, indeed, that it is to liquid air that we must look as our most profitable source of heat. Its oxygen is to be extracted, bottled up, and used in our steamships, locomotives and reducing furnaces in such magical fashion as to produce the usual "revolution" in the field of transportation and manufacture. This latest fallacy has been exposed in the very convincing article by President Morton, which, by the courtesy of The Stevens Indicator, we are enabled to reproduce in full in the current issue of the SUPPLEMENT.

The latest claim of the promoters is that, by distilling off its nitrogen, liquid air may be utilized as a means of producing oxygen gas in large quantities and at a relatively low cost. While it is admitted that pure oxygen could be obtained cheaply in this way. President Morton shows that as it costs, according to Mr. Tripler, twenty cents to produce a gallon of liquid air, and as it requires five gallons of liquid air to produce one gallon of oxygen, the cost of production must be one dollar per gallon, or about ten dollars per thousand cubic feet at atmospheric temperature and pressure. It is admitted that this is less costly than the present methods, but it is pertinently asked, "What shall we do with the cheap oxygen when we get it, the present uses for oxygen being very limited and chiefly confined to the lime light and some refined processes in metallurgy?"

The liquid air prospectus tells us that the oxygen is to be used as a substitute for air in the ordinary processes of combustion, as under steam boilers, in iron furnaces, and the like; but used under these conditions it would be in competition with free air, and the cost of the storage or transportation, as the case might be, would be altogether prohibitory. It is argued that the most conclusive way to test the value of this suggestion is to reduce it to a concrete case, with actually calculated proportions of parts, volumes and weights; and because the necessary data is easily obtained, President Morton takes as his text the case of a large transatlantic steamer. He argues that since every ton of coal requires 2½ tons of oxygen for its consumption, and as it takes about 2,000 tons of coal to carry one of these ships across the Atlantic, the transportation in storage cylinders of the 5,000 tons of compressed oxygen thus shown to be necessary for the combustion of the coal, would reduce the carrying capacity of the ship to practically nothing, the coal and the compressed oxygen aggregating a dead load of 7,000 tons, to say nothing of the weight of the storage cylinders.

If the gas were not compressed, each ton of coal would require 66,000 cubic feet of gas, and the whole 2,000 tons would require 132,000,000 cubic feet. Even if forty per cent of the fuel were to be saved, as claimed by the promoters, it would be necessary for the ship to carry twenty-two tanks of the size of the huge gas holders which form such a conspicuous feature in any distant view of New York city.

Your promoter, however, is nothing if he is not ready-witted, and he will, of course, suggest that the idea of storage was never in his mind, and that each vessel would carry the oxygen-manufacturing plant on board, and would make the gas as it was needed. It is sufficient to say that the necessary plant to produce the 1,250 tons of oxygen which would be needed per day for the 500 tons of coal consumed daily in the furnaces of the steamship "Campania" would call for boilers and engines that would rival in bulk and weight the engines and boilers that propel the ship.

Lastly, attention is drawn to the fact that the enormous intensity of the temperature produced by the combustion of fuels in oxygen would lead to the burning and melting down of the furnaces in which it was tried. A pound of coal burnt under these conditions would not yield a greater quantity of heat, but would simply develop the same quantity in less time, with a proportionate increase in the intensity of the heat.

ECONOMIC VALUE OF GOOD ROADS.

There is food for thought in the report of the Maryland Geological Survey for 1899. In the first place we are told that the people of Maryland have expended, during the last ten years, upon the so-called construction and repair of their own roads, the sum of no less than $6,000,000. It seems that the greater part of this money has been frittered away in the attempt to repair roads which have been poorly laid out in the first place, and for the lack of certain necessary engineering qualifications can, in the nature of things, never be made into good roads. As an instance of this it may be mentioned that many of the common roads have no natural drainage. We are told that most of them are in a poor condition for a part of the year, and some of them for the whole twelve months.

As the result of a careful estimate made by the survey, it is shown that the farmers of the State of Maryland expend $3,000,000 a year more on their hauling over the present poorly built highways than would be necessary if the hauling were done on first-class roads. These figures are to be compared with the information collected by the Department of Agriculture in 1895, when, as the result of data received from over twelve hundred counties in various parts of the United States, it was ascertained that the average cost of hauling one ton for one mile over country roads was twenty-five cents; which was just three times as much as the average cost of hauling over the improved macadam roads of six European countries. If this large sum of money represents the loss to the State of Maryland from poor roads, it is easy to say that the total loss throughout the whole United States represents a figure so great that it must have an important bearing upon the prosperity of the country at large, and particularly upon the farming interests as such.

At first sight it seems incredible that in a country so progressive as ours the condition of the common roads should be over a half century behind that of the old world. It is true that the vast extent of the United States, and the great mileage of our roads in some States relative to the density of the population, may be offered as an excuse for our backwardness; but while this plea may hold good as regards the thinly populated Western and Southern States it cannot be applied to the older, more populous and wealthy sections of the country.

COMMERCIAL EXPANSION AS A SCIENCE.

Our last issue contained a letter in which the writer contrasted the business methods of German and American merchants, and proved how, in many ways, Germans showed more business sagacity in dealings with South American firms. According to our correspondent, the secrets of German success are not far to seek. The inability of many American commercial travelers to speak the language of the country to which they are sent; the elaborate American price lists and catalogues, with their complex and useless system of discounts from list prices; the refusal to extend credit; and the inability or unwillingness to humor the customer, go far to offset the superior quality of American goods.

But there are still other reasons why Germany in many parts of the world is slowly but surely outstripping her sister nations in the struggle for commercial supremacy—reasons which are apparent only to him who has made a careful study of German industry on its native heath. Such a study is to be found in the work of a Frenchman, Maurice Schwob, which bears the dramatic title, "*Le Danger Allemand.*" The book has forcibly brought home to Frenchmen the necessity of very radically modifying their commercial system, if they desire to regain even a tithe of what they have lost in foreign trade. Fortunately, the American business man is far more energetic than his French *confrère* for which reason Schwob's criticisms of his countrymen can hardly be applied to us. Nevertheless, his analysis of German methods is so instructive, is based upon facts so little known, as to warrant a brief review of his book.

"The German Danger" is discussed by Schwob in five sections—"The Sea Danger," "The Industrial Danger," "The German System," "German Advertising," and "The Conquest of Markets."

"The Sea Danger" for France lies in the decline of the shipping interests of her ports. Besides the successful competition of Hamburg with Liverpool, Schwob notices the development in shipping at Antwerp and Rotterdam, both of which cities owe their unexpected commercial good fortune to the fact that they are outlet ports for the Rhine, by which the products of Frankfort, Mannheim, Mayence, Düsseldorf, and other river towns are transported to the sea. The benefits to be derived by shipping to Antwerp were found to be so advantageous to Frenchmen that the head of the Department of Meurthe-Moselle stated that not only was a part of France thus annexed to Belgium, but that Germany and Belgium together threatened commercially to incorporate the whole of France.

"The Industrial Danger" has also given Schwob much concern. The German government, he finds, understands thoroughly the making of commercial treaties which enable home industries to thrive despite the keenest foreign competition. The revenues obtained from the taxing of imports are not all swallowed by the national treasury; but a certain part of the money received is paid out as premiums for the exportation of German goods. The bureaucratic political system of France, says Schwob, renders a co-operation of the government authorities and merchants impossible. Tariff systems are made and unmade in a day. Laws, ill timed and badly framed, go into effect, which, although designed to check foreign invasion, really cripple French industries. Officials are "politicians" in the very sinister sense which that much-abused word has acquired in the United States. In Germany, on the other hand, the government and the merchants work in harmony. Bills are introduced and passed in the Reichstag exactly when they are most needed, and are so broad in their scope that the hands of the exporting manufacturer cannot be tied by official red tape. Schwob cites a striking example of this intelligent co-operation. For years, German shipbuilders had been purchasing their iron and steel from English foundries. At a convention of German ironmongers and shipbuilders, it was decided that German foundries were thereafter to deliver the steel required by the shipbuilders. It was found necessary to reduce the railway freight-charges on iron; the government immediately provided lower rates, "of its own accord" (*spontanément*), writes Schwob maliciously, for in France the officials rarely act "*spontanément.*" And the shipbuilders agreed to pay from three to five per cent more for German than English iron, in order that the home industry might flourish. No protective tariff was established.

Germany's method of "conquering markets" is due primarily to the "floating expositions" sent to all parts of the world. A syndicate of merchants charters a steamer, loads her with goods carefully selected for foreign buyers, sends her from port to port, in accordance with a schedule prepared with characteristic German attention to detail. Representatives of the firms are sent ashore at the various cities. Each man speaks the language of the country fluently; he studies the needs of the population; he distributes samples and intelligently compiled catalogues, and takes orders for goods; in a word, he does everything in his power to further the interests, not only of his firm, but of German commerce as well. When his report has been handed in, a swarm of commercial travelers settles down in the country visited, all of them thoroughly familiar with the business methods of the people, and ready to build on the foundations laid by their predecessor.

Second in importance only to the "floating expositions" are the export associations that, for the last ten years, have maintained trade museums or bazaars for the purpose of exhibiting their wares, and for sending expeditions to all parts of the world, in order to accustom the people to the use of German products, to distribute catalogues of samples, lists of export houses and the goods sold by each. Is it any wonder that one can pick up everywhere so many articles of manufacture that bear the familiar inscription "Made in Germany"? Is it any wonder that not only Africa and South America and the countries of the Orient have been thus commercially conquered by the "indomitable German," but also Norway, Denmark, Holland and Russia—"countries," says Schwob, "that are our friends, and hate and fear Germany."

Although it is primarily intended for his countrymen, Schwob's study contains many a lesson by which American merchants may well profit. Our exports, it is true, have never been so large as in the last ten years; and at the close of each year the records show that there is not a single branch of industrial activity in which we have not made some progress. What we have gained has been gained not so much by concerted action as by the efforts of individual firms. Our progress has been great; but it should be still greater. And only by systematic aggression, by the establishment of more institutions similar to the Philadelphia Commercial Museum, and by arranging more exposi-

tions like the Pan-American Exposition, to be held in 1901, can we hope to compete with the German in markets which he hopes some day to consider exclusively as his own.

ROBERT SIMPSON WOODWARD.

BY MARCUS BENJAMIN, PH.D.

After an absence of thirteen years the American Association for the Advancement of Science returns to New York and will hold its forty-ninth meeting in this city during the week beginning with June 25.

In 1887, Dr. Samuel P. Langley, the secretary of the Smithsonian Institution, presided over the meeting, succeeding on that occasion Edward S. Morse, the director of the Peabody Academy of Science, in Salem, Mass. For this meeting Robert S. Woodward has been chosen to preside, and he will succeed Grove K. Gilbert, of the United States Geological Survey, who was elected last December to fill the unexpired term of the late Edward Orton, a sketch of whom appeared in the SCIENTIFIC AMERICAN for August 18, 1899.

Prof. Woodward was born in Rochester, Mich., on July 21, 1849. Loyal to the State of his birth, he entered the University of Michigan, in Ann Arbor, and was graduated there in 1872 with the degree of Civil Engineer. An appointment as assistant engineer in the United States Lake Survey was offered to him, and for ten years he continued in that service.

In 1882, he resigned from the Lake Survey to become astronomer on the United States Transit of Venus Commission. Two years later he passed to the service of the United States Geological Survey with which he remained for six years, serving in the successive capacities of astronomer, geographer, and chief geographer. He then became an assistant in the United States Coast Survey, with which he continued for three years.

The death of Prof. William P. Trowbridge, in 1892, created a vacancy in the scientific faculty of Columbia University that at first sight seemed almost impossible to fill, and indeed the department over which he had charge was so extended that the difficulty was only met by dividing his chair into several co-ordinate professorships. To that which was designated as Mechanics, Prof. Woodward was called, he having gained his professorial title by filling, during 1886–88, the chair of civil engineering in the Corcoran Scientific School of Columbian University in Washington, D. C., where he acquired much reputation by his success as a teacher.

The choice of the trustees proved a wise one, for with the growth of the college into a university, additional duties have been assigned to Prof. Woodward in the accomplishments of which he has shown exceptional ability. It is not necessary to enumerate the various offices that he holds in connection with Columbia, and they are many, for the most important is that of Dean of the School of Pure Science, which he has filled since 1895, and it is sufficient to show the high esteem in which he is held by his associates.

His scientific work has included numerous contributions in the domains of precise mensuration, geodesy, the physics of the earth, physical astronomy, and pure mathematics, and of the hundred or more titles of papers that he has published the following are the more important: "On the Actual and Probable Errors of Interpolated Values from Numerical Tables by Means of First Differences" (1882); "Results of Experiment to Determine the Variations in Length of Certain Bars at the Temperature of Melting Ice" (1883); "On Errors Incident to Interpolated Values from Numerical Tables" (1886); "On the Free Cooling of a Homogeneous Sphere" (1887); "On the Conditioned Cooling and Cubical Contraction of a Homogeneous Sphere" (1887); "On the Diffusion of Heat in Homogeneous Rectangular Masses, with Special Reference to Bars Used as Standards of Length" (1887); "On the Form and Position of the Sea Level" (1888); "The Effects of the Atmosphere and Oceans on the Secular Cooling of the Earth" (1890); "Recent Experience of the United States Coast and Geodetic Survey in the Use of Long Steel Tapes for Measuring Base Lines" (1893); "The Iced Bar and Long Tape Base Apparatus, and the Results of Measures made with them on the Holton and St. Albans Bases" (1892); "An Historical Survey of the Science of Mechanics" (1894); and "Mechanical Interpretation of the Variations of Latitudes" (1895); and in book form the "Smithsonian Geographical Tables" (1894), a volume of nearly three hundred pages, published by the Smithsonian Institution.

The degree of Ph.D. was conferred on him by his Alma Mater in 1892, and in 1896 he was chosen to membership in the National Academy of Sciences. For more than ten years he has been an associate editor of The Annals of Mathematics; and since 1894 he has been an associate editor of Science; also, he is one of the editorial corps of The Columbia Quarterly.

The American Mathematical Society has honored him by successive elections to the offices of treasurer, vice-president, and president, and he is now president of the New York Academy of Sciences.

He joined the American Association for the Advancement of Science, at its Philadelphia meeting held in 1884, and a few years later was elected to the vice-presidency over the section of Mathematics and Astronomy; delivering an address at the Toronto Meeting in 1889, on "The Mathematic Theories of the Earth," which attracted considerable attention and was largely reprinted in the scientific journals of this country. In 1894, he was chosen treasurer of the association, an office which he still holds. Prof. Woodward has on several occasions been urged for the presidency of the association and would have been elected at the Boston meeting two years ago had he not gracefully withdrawn in favor of Prof. Edward Orton.

Applied Mathematics has no more distinguished representative in this country than Prof. Woodward, and the association has honored itself by choosing its most loyal member in that branch of science to preside over its sessions to be held in this city.

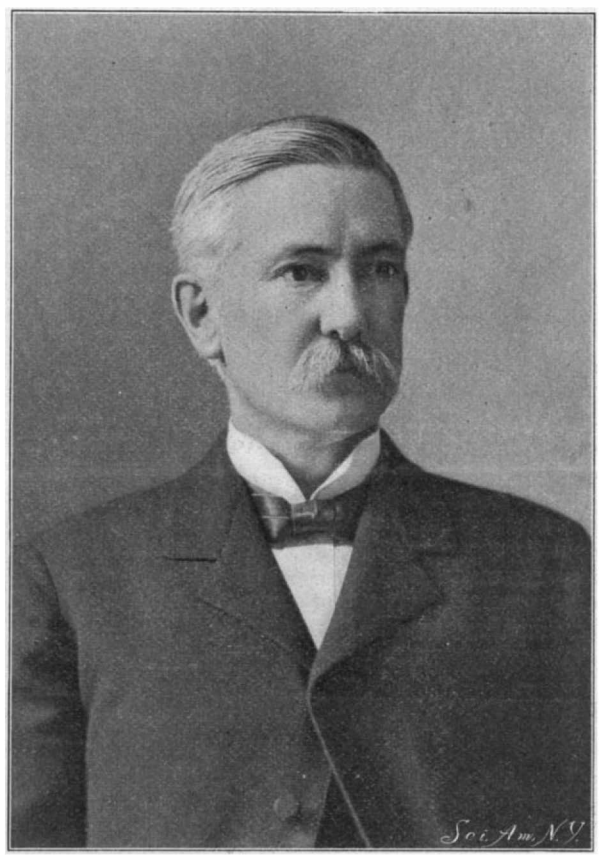
THE HEAVENS IN JULY.

BY HENRY NORRIS RUSSELL, PH D.

Astronomers have never had less occasion to complain of the weather than on the 28th of last May. All along the eclipse tracks, from the Gulf of Mexico to Northern Africa, cloudless skies were the rule, and no one seems to have been unable to see the sun.

But for this very reason, it will be some time before the results of the day's observations are fully known. At the time of writing it is hardly probable that all the eclipse plates have been developed, and their measurement and reduction, especially in the case of those of the spectrum, and those made in the search for a possible intra-mercurial planet, will take a lone time.

The present statement must, therefore, deal simply with some of the results obtained by the Princeton University party stationed at Wadesboro, N. C.



ROBERT SIMPSON WOODWARD.

The eclipse was an unusually bright one, a great deal of light being diffused into the shadow from the illuminated air outside its limits, so that only first magnitude stars were visible, and it would have been perfectly easy to read an ordinary watch face during totality.

The observations of the corona and lower layers of the sun's atmosphere showed that the sun's surroundings were in a decidedly quiescent state. The flash spectrum was faint, and the prominences relatively few—only one being large—while the unknown gas which produce the green line in the spectrum of the corona was conspicuous by its absence, being too faint to be seen or photographed at all, and disappointing those who tried to observe it.

The form of the corona was very close to that predicted by Hansley, showing long equatorial extensions and short curved rays near the poles.

The inner corona showed very little telescopic structure, with no conspicuous evidence of connection with the prominences.

The shadow bands, which appear just before and after totality, were well seen. They moved in different directions at the stations only a short distance apart—a circumstance which strongly supports the theory that they originate in the earth's atmosphere.

About fifteen good negatives of the corona were obtained with instruments up to 12 feet focal length. Those, with exposure of 20 seconds, show extensions of the corona considerably more than the sun's diameter in length.

THE HEAVENS.

At 10 P. M. on July 15, the constellations of summer are visible to great advantage.

The Milky Way forms a great arch across the east, with one foot almost under the pole and the other in the extreme south; and along its line are the constellations described last month.

The present is a good time to note the complex structure of the Galaxy. From Cygnus to the southern horizon it is divided into two streams of unequal brightness and variable width, with several marked condensations and knots, of which the brightest are in Sagittarius, near the southern horizon.

In the northwest appears the Great Bear, standing on his head, and the west is lighted by Arcturus and Spica, the latter being near its setting. The southern constellation Scorpio and Sagittarius are at their highest above our horizon. Scorpio is identified by the presence of Jupiter within its borders, and Sagittarius by the fainter and yellower Saturn and also by the little group of stars called the Milky Dipper, which, though it is in the Milky Way, must always be empty, for it is wrong side up.

In the southeast is a pair of moderately bright stars close together which is worth looking at. They are Alpha and Beta Capricorni and are both double. Alpha—the upper one—has a close companion on the right and a fainter and more remote one on the left. Both are visible to a good eye without a glass. Beta shows in a field glass a still closer companion of the seventh magnitude. With the telescope the stars are much more remarkable. The companions of both Alpha and Beta are double in powerful telescopes, and the companion of Alpha is separated by the most powerful instruments into two stars!

THE PLANETS.

Mercury is in Cancer, and is evening star till the last day of July, setting nearly two hours after the sun on the 1st and easily visible in the evening twilight. On the 31st he is in inferior conjunction with the sun and becomes a morning star again.

Venus is the evening star at the beginning of the month, but sets only ¾ of an hour after sunset, and rapidly approaches the sun, passing inferior conjunction on the 7th. As she passes south of the sun she will be invisible to the unaided eye till late in the month, when she reappears as morning star, and rises about an hour before the sun on August 1. Those who have telescopes may follow with interest the narrowing of her crescent, and may, perhaps, see its extension beyond the half of her circumference, due to twilight in her atmosphere.

Mars is being slowly overtaken by the earth, but is still far from opposition. He moves eastward through Taurus during the month and rises between two and three hours before the sun.

Jupiter is in Scorpio, and is well up in the southeast at sunset. The belts on his surface and his satellites are beautiful objects in the smallest telescope. To aid the identification of the outer two, last months list of their positions is continued.

Satellite III. will be east of Jupiter on the 1st, 8th, 15th, 22d and 29th, and west on the 4th, 11th, 18th and 25th.

Satellite IV. will be east on the 6th and 23d, and west on the 15th and 31st.

Saturn is just past opposition and is visible throughout the night, but as he is as far south as possible and at his greatest distance from the sun the present opposition is very unfavorable.

He figures, however, in the most interesting astronomical event of the month, for American observers—an occultation on the 10th visible throughout the United States.

As in the case of a solar eclipse and for the same reason, the time of the phenomenon is different at different places. At Washington Saturn disappears behind the moon's dark limb at 10:43 P.M., and reappears at 12:05 A.M. from behind the bright limb.

The local time of occultation will be about an hour earlier in the Middle West, and two hours earlier on the Pacific Coast. It will take about a minute and a half for the moon to hide the planet, so that the gradual character of the decrease of its light will be evident to the naked eye, while with the telescope the spectacle of the moon's dark limb slowly and steadily hiding the rings and ball of the planet will be one of uncommon interest.

Uranus is in Scorpio east of Jupiter, and Neptune is too near the sun to be seen.

THE MOON.

First quarter occurs on the night of the 4th, full moon on the afternoon of the 12th, last quarter on the morning of the 19th, and new moon on the afternoon of the 26th. The moon is farthest from the earth on the 3d and again on the 31st, and nearest on the 15th.

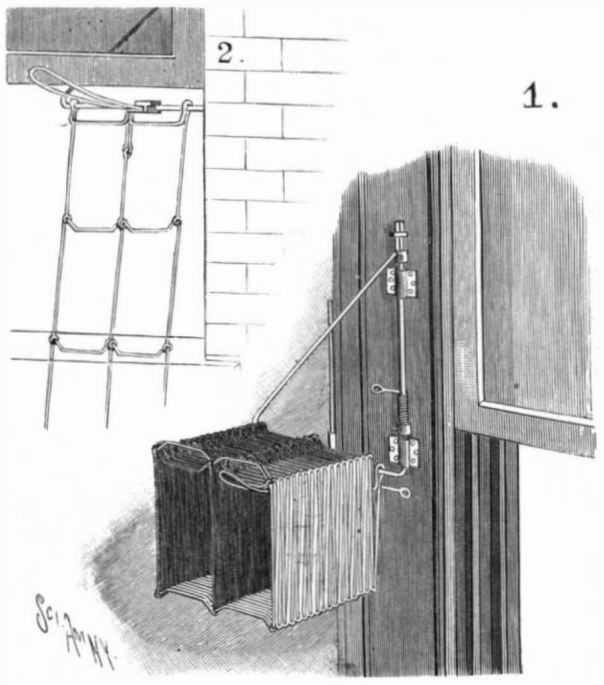
In addition to the occultation of Saturn there should be noted conjunctions of the moon with Jupiter on the afternoon of the 8th, Uranus the following morning, Mars on the afternoon of the 22d, Neptune on that of the 23d, Venus on the forenoon of the 24th and Mercury on the night of the 26th.

Princeton University Observatory.

A SELF-LAUNCHING FIRE-LADDER.

Our illustrations picture a very ingenious and inexpensive fire-ladder, invented by Mr. Theron N. Parker, of 226 North Ninth Street, Brooklyn, New York city, which ladder is so arranged that by releasing a retaining device, it will be automatically thrown out of an open window into the street.

Held in bearings at the side of the window, well above the head of a person, is a bracket in the form of a right-angled triangle. The base of this triangular bracket carries a steel loop which supports the folded steel ladder, made in any desired length. In order to



THE LADDER FOLDED AND LAUNCHED.

reinforce the loop, and to hold it in substantially horizontal position, a vertical brace is employed, extending upwardly behind and in contact with the hypotenuse of the triangle. The vertical member of the triangular bracket, journaled in the bearings, is surrounded by a powerful coiled spring, the upper end of which is extended laterally to form a stop, which limits the inward motion of the bracket. A fastening device which can be released by a pull-cord, lever, or electric push-button is provided for the base of the bracket.

When the fastening device is released, the strong steel spring instantly swings the bracket through a semicircle to the open window, with such speed that the momentum acquired launches the fire-ladder into the street, so that it hangs as shown in our illustration.

Not the least interesting feature of this simple device is the construction of the ladder. It will be observed that side runs are employed, between which, rungs extend, having offset portions serving as footholds. So compact is this ladder, that a length equivalent to five stories can be packed in less than a cubic foot of space. The ladder is light; for it weighs but two pounds to the story. It is strong; for the severe tests to which it has been subjected have shown that it is capable of supporting a weight of one thousand pounds with perfect safety, and without any possibility of entangling. When the ladder is launched by means of the push-button or lever, a strong, trustworthy escape is formed for each floor in the line of the windows—an escape by which firemen, if necessary, can ascend to any floor. The bracket, it is evident, can be quickly placed in position on any window.

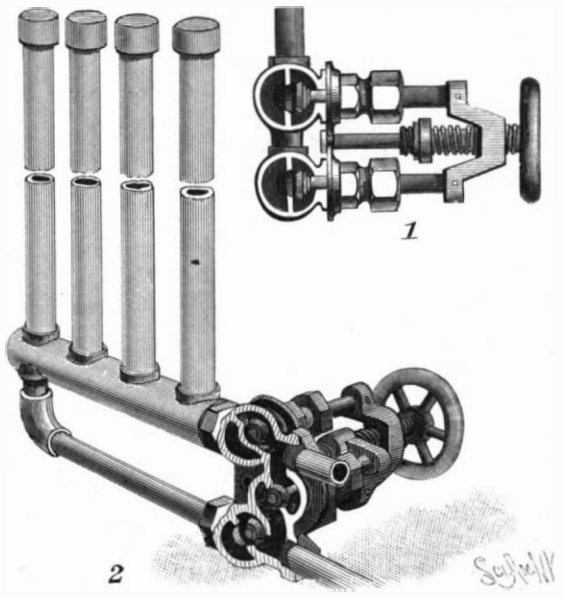
THERE is a project for another subway in Boston, to connect under Washington Street with the present subway, and the one to East Boston, on which work was started a few weeks ago, has been laid aside for a year at least, says The Western Electrician. The matter has been the subject of many petitions and much remonstrance, and the committee on metropolitan affairs in the legislature voted to refer the bill to the next General Court.

AN IMPROVED VALVE FOR STEAM RADIATORS.

An invention has been patented by Mr. Timothy S. Martin, of Butte, Mont., which provides a simple valve mechanism particularly adapted for use on radiators through which exhaust steam is passed, and designed to reduce back pressure against the engine. Fig. 1 is a central sectional elevation of the invention with parts broken away. Fig. 2 is a perspective view, also with parts broken away.

The radiator is constructed with the usual upright tubes connected with upper and lower horizontal circulating-tubes. At the end of the circulating-tubes, a valve casing is located, comprising two chambers, which can be connected with the steam-supply. A central apertured partition separates the chambers. The casing has also two outer chambers and two outer apertured partitions, one between each outer chamber and the adjacent chamber connected with the steam supply. A central valve is arranged to open and close the aperture in the central partition; and two lateral valves are arranged to close the apertures in the outer partitions. A cross-head connects the outer valves and has a screw-threaded aperture. A head connected with the central valve has an aperture with a screw-thread of a direction opposite to that of the cross-head, the two threaded apertures being alined axially. A valve-operating shaft is mounted to turn in the casing, but is held against longitudinal movement, and is provided with screw-threads of opposite directions engaging the oppositely threaded apertures of the heads.

When the center valve is closed, the outer valves are opened (Fig. 1), so that the steam enters one of the circulating-pipes, passes through the outer chamber and open partitions to the radiator and returns through the other circulating pipe. If the center valve be opened by turning the shaft previously mentioned, the inlets to the radiator will be closed, and steam will not enter the radiator. It is evident that under these conditions the steam will not encounter a solid, closed valve, as in the customary construction, but will pass through the valve-casing and back to the boiler, thereby obviating the back pressure usually caused by cutting off the steam at the radiator.



THE MARTIN RADIATOR VALVE.

EXAMINATION OF THE DRINKING WATER OF BROOKLYN, NEW YORK.

The advances in sanitary science in the past few years are nowhere more marked than in water examination. The splendid work done by the Massachusetts State Board of Health has been followed by the installation of laboratories in most of our American cities for the examination of the water furnished by the municipality. It is naturally understood that departments of water supply should be responsible for the quality, as well as the quantity, of water furnished. This demands a constant knowledge of the sanitary condition of the water supply, which can be attained only by frequent analyses and inspection.

The water supply of Brooklyn is complicated, and the need of a laboratory was apparent to the Department of Water Supply for several years. In 1897, Mr. George C. Whipple, Associate Member of the American Society of Civil Engineers and author of several works upon sanitary water supply and examination, was appointed biologist and director. The old gate-house on the Mount Prospect reservoir was found to have ample accommodations, and it was remodeled to meet the peculiar conditions of a chemical and biological laboratory. In the SUPPLEMENT for the current week there is a very full paper upon the Mount Prospect laboratory, presented by Mr. Whipple before the Brooklyn Engineers' Club. It deals with the collection of samples and with the work carried on, and to this article we refer our readers who desire more extended information on the subject.

The laboratory occupies the upper portion of the building and is divided into three rooms. One room is known as the general laboratory, the second the biological laboratory, and the third the chemical laboratory. In the basement is a physical laboratory, storeroom, etc., and there is a sub-basement suitable for bacteriological work during hot weather. The laboratories are equipped with the latest apparatus known to science, including ice chests for the storage of culture media, incubators, sterilizers, balances, desiccators, steam baths, stills for ammonia distillation, Sedgwick-Rafter filters, a combustion furnace, a Mahler bomb-calorimeter, etc. The laboratory force consists of one biologist and director, one chemist, one assistant chemist and three assistants. The routine work consists of the regular examination of the samples of water received from all parts of the watershed and distribution system, i. e., from the driven wells, streams, ponds, aqueducts, reservoirs, etc. The complicated and varied character of the water supply requires the examination of an unusually large number of samples, and it is safe to say that no water supply in this country is examined more thoroughly and minutely than that of Brooklyn.



THE CHEMICAL LABORATORY OF THE MOUNT PROSPECT LABORATORY FOR THE BIOLOGICAL AND CHEMICAL ANALYSIS OF BROOKLYN'S DRINKING WATER.

The regular routine includes the bacteriological examination of three samples of water from the Ridgewood pumping station and from a tap in the city collected daily; a complete physical, chemical and biological examination of nine samples from the distribution system collected weekly; the physical, biological and partial chemical examination of twenty-four samples from the supply ponds collected weekly, with complete chemical analyses monthly; the complete examination of nineteen samples from driven wells collected monthly; and the complete examination of twenty-one samples from the private water supply companies of Brooklyn and from the water supply of the Borough of Queens collected quarterly. Many extra samples are taken at various times and places as occasion requires.

The samples of water from the watershed are collected in the forenoon during the early part of each week, and are sent to the laboratory by express. The samples are collected in large bottles for chemical analyses, and in small sterilized bottles for bacteriological examination. The bottles for the bacteria samples hold two ounces, and they are sterilized each time before use. The stoppers are covered with pieces of tinfoil, and each bottle is then placed in a screw-capped

tin box just large enough to receive it. The bacteria samples are shipped in portable ice boxes. There is an outer box with asbestos packing and a copper lining, and an inner copper tray divided into compartments to hold the tin boxes just mentioned, and between the outer boxes and the tray is a large space for ice. The boxes hold sufficient ice to last eight hours in hot weather.

The samples are almost invariably received in good condition. When the samples reach the laboratory, each is given a serial number and entered in an index book. The physical examination of water includes the temperature of the sample at the time of collection, the amount of sediment, and the turbidity after standing twelve hours, the color and the odor.

The sanitary chemical analysis ordinarily includes the determination of nitrogen as albuminoid ammonia, free ammonia, nitrites and nitrates; total residue on evaporation, loss on ignition, chlorine, iron and hardness. In addition to these the following determinations are sometimes made: Oxygen consumed, alkalinity, incrusting constituents, dissolved oxygen, carbonic acid, etc.

Microscopical examination of the water determines the number and kind of microscopic organisms present, together with the amount of amorphous matter. The bacteriological examination consists of the determination of the number of bacteria present in the sample of water and a qualitative test for the presence of bacillus coli communis.

The miscellaneous work in the laboratory includes the analysis of coal, lubricating oil, boiler scales, boiler compounds, cements, deposits from driven wells, etc. These are all problems of engineering chemistry, and the most important part of this work is the analysis of coal. Most of the experimental work that has been carried out in the laboratory has been in connection with problems pertaining to the condition of the water supply; but, in addition to this, considerable attention has been given to the study of methods of water analysis and to other subjects of scientific interest. Probably the most important work of this kind was the ascertaining of the normal chlorine for the watershed of the Brooklyn water supply, and the observations have been extended over the whole of Long Island. Samples were collected from seventy-seven sources and from the results of their examination, a map of normal chlorine for the island has been prepared. This map shows that except at the east end of the island, and except near the coast, the normal chlorine is below six parts per million. The results which have been obtained by the establishment of this laboratory would warrant other cities in opening similar laboratories.

"LAWN tennis elbow" is one of the modern complaints, and appears to be associated with a certain stroke used by expert players. It is sometimes caused by a sudden strain or long-continued overstrain.

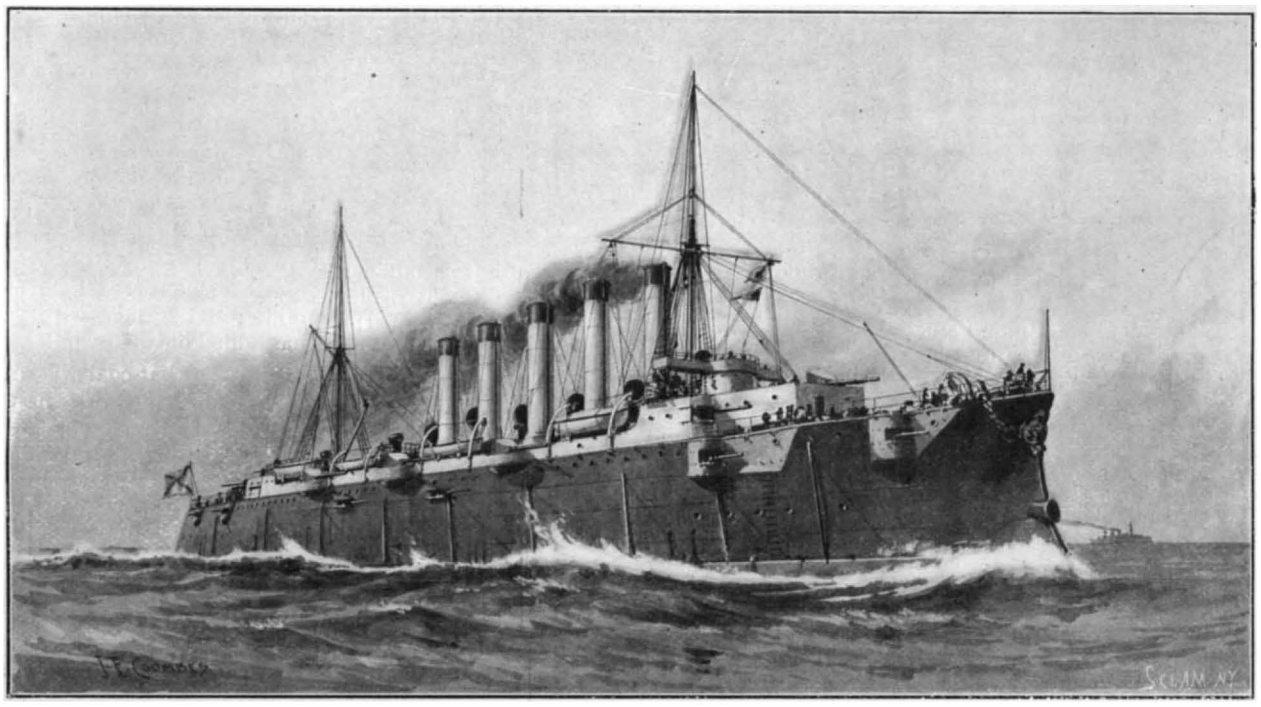
TWO NOTABLE HIGH-SPEED FOREIGN CRUISERS.

It is now many years since our famous high-speed cruisers, "Minneapolis" and "Columbia," startled the naval world by the then unprecedented speed which they achieved on their trial runs. The "Columbia," it will be remembered, maintained on her trial an average speed of 22·8 knots an hour, while the "Minneapolis" was officially credited with an average of 23·07 knots an hour. Nothing of the kind had hitherto been accomplished by vessels of the size and sea-going ability of these ships, and it is a fact that to accomplish these results considerable sacrifices were made in their offensive and defensive qualities. The armament was light, and the protection was confined to an armored deck. Contemporary vessels of the "Minneapolis" and "Columbia" that carried heavy armament and were protected with a belt at the water line, such, for instance, as the "New York" and "Brooklyn," only secured these advantages by a sacrifice of speed.

Improvements in the materials of construction, the introduction of tubular boilers, and the construction of engines suited to a high speed of revolution, have enabled designers to provide heavily armored vessels with a speed which was altogether impossible at the time the "Minneapolis" and "Brooklyn" were built, with the result that it is getting to be quite the fashion to provide even the armored cruisers with sufficient power to drive them at speeds of from 22 to 24 knots an hour.

We present illustrations of two of the latest of the high-speed cruisers that have been built in European yards. Both of them are required by contract to achieve a speed of 23 knots an hour. One of them, the "Chateaurenault," has had her trials, and has easily exceeded 23 knots an hour, the speed on certain stretches of the trial course reaching within a fraction of 25 knots per hour.

I. "Askold."—The "Askold" is one of the four protected cruisers which are being built for the Russian navy in foreign shipyards. One of these, the "Waryag," has been constructed at the Cramp shipyard, Philadelphia; and is now undergoing her trials. Two others, the "Bogatyr" and the "Boyarin," have been built respectively at Stettin and Copenhagen, while the "Askold" is nearing completion at the Germania yard, Kiel. All four vessels are to have a speed of 23 knots an hour, and carry the same armament, although there will be a difference in the matter of its disposition. The "Askold" has a displacement of 6,000 tons on a draught of 20 feet 4 inches. She is 426 feet 6 inches in length, 49 feet 3 inches in beam, her normal coal supply is 710 tons, while her bunker capacity is 1,000 tons.

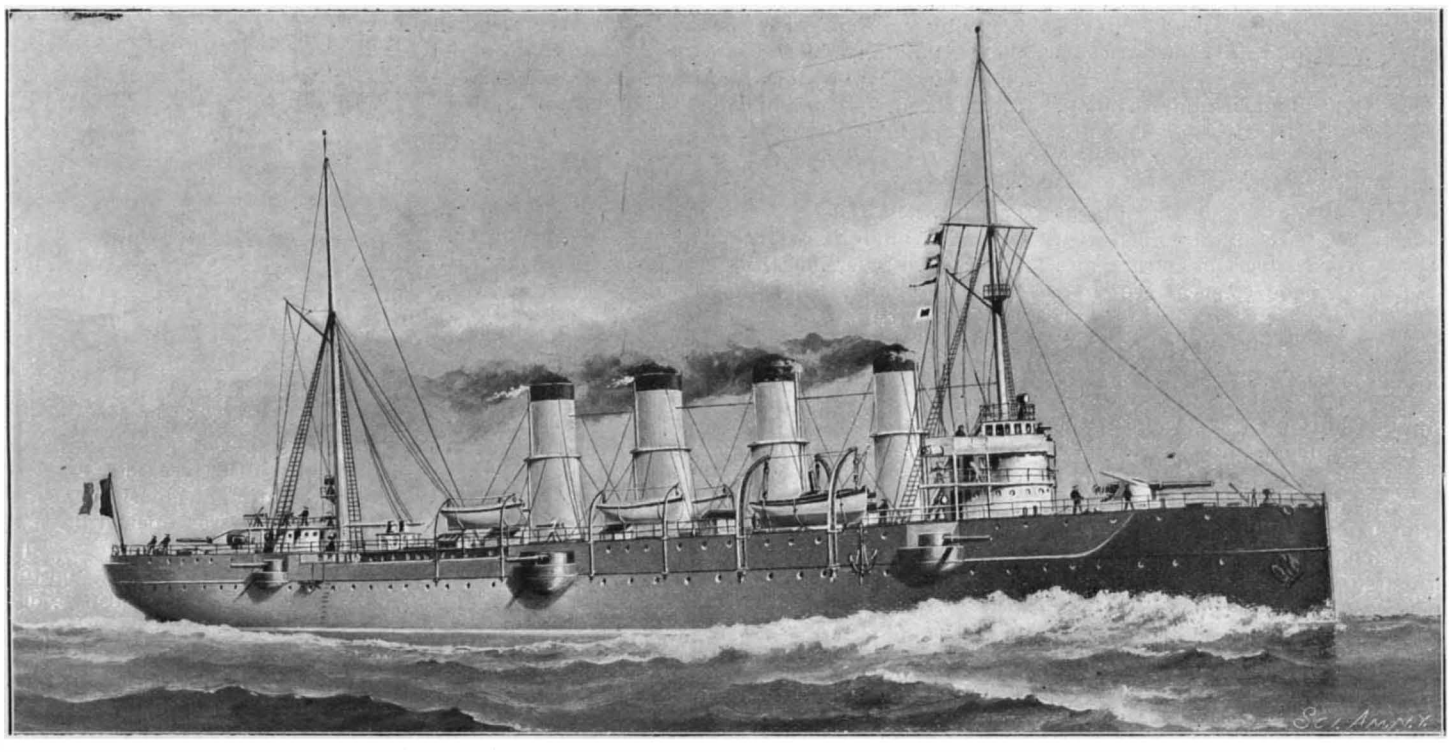


RUSSIAN, 23 KNOT, PROTECTED CRUISER, "ASKOLD."

Displacement, 6,000 tons. **Speed,** 23 knots. **Maximum Coal Supply,** 1,000 tons. **Armor:** Deck, 3 inches; gun positions, 3 inches and 5 inches. **Armament:** Twelve 6-inch rapid-fire; twelve 3-inch rapid-fire; eight 3-pounders; two 1-pounders; two machine guns. **Torpedo Tubes,** six. **Complement,** 500. **Date of Completion,** 1900.

It will be noticed that the ratio of beam to length in the "Askold" is about 1 to 9; a most exceptional proportion for a warship, and one that is only found in fast steamers of the merchant marine, and in small fighting craft of the torpedo boat and destroyer type. In this respect the "Askold" differs materially from the other three vessels of her class, the "Waryag," for instance, having a beam of 52 feet and a length of 420 feet, or about 1 to 8. In consequence of her finer lines the "Askold" is 500 tons less in displacement than her sister ships, the "Waryag" displacing 6,500 tons and the "Askold" 6,000 tons.

Her armament is identical with that of the "Waryag," although it is somewhat differently disposed. It consists of twelve 5·9-inch guns, of which six will be mounted in sponsons, three on each broadside on the main deck, while four will be mounted in recessed ports on the same deck, two forward and two aft. Of the other two guns, one will be mounted on the quarter-deck and one will be mounted on the superstructure deck, above the forecastle, and well toward the bow. All of the above guns will be of the rapid-fire type. The "Askold" will also carry a dozen 3-inch rapid-fire guns, four forward, four aft, and four amidships on the gun deck; eight 3-pounders, two 1-pounders and two automatic machine guns. She will also be provided with six torpedo tubes, two of which will be submerged. The protective deck will be 3 inches in thickness, and the principal gun positions will be protected by 5-inch to 3-inch nickel steel.



FRENCH, 23 KNOT, PROTECTED CRUISER, "CHATEAURENAULT."

Displacement, 8,018 tons. **Speed,** 23 knots. **Maximum Coal Supply,** 2,100 tons. **Armor:** Deck, 2¾ inches horizontal, 4 inches on slopes; gun positions, 2¾ inches. **Armament:** Two 6·5-inch rapid-fire guns; six 5·5-inch rapid-fire guns; ten 3-pounders and five 1-pounders. **Complement,** 625. **Date of Completion,** 1900.

It must be confessed that the "Askold" has a very striking appearance, and is suggestive of an overgrown torpedo boat destroyer more than of a first-class cruiser. This is due in part to her possession of no less than five tall smokestacks, a number which has never before been placed on a warship. Her boilers will be of the water-tube type, and will supply steam to three sets of triple-expansion engines, driving three propellers, a system which was adopted with success in

our own "Minneapolis" and "Columbia." The complement of the "Askold" is to be 580 officers and men. If our readers wish to make further comparison of this fine vessel with the sister ship recently built by the Cramps, they are referred to the SCIENTIFIC AMERICAN of November 5, 1898, in which will be found an illustrated description of the "Waryag."

II. "Chateaurenault.—The French protected cruiser, the "Chateaurenault," was laid down at La Seyne in 1896 and launched in 1898. She is 443 feet long between perpendiculars, has a beam of 55 feet 9 inches, and a mean draught of 22 feet 6 inches with a displacement of 8,018 tons. She is thus about 600 tons larger than the "Minneapolis." Like her, she is driven by three sets of vertical, triple-expansion engines. The boiler plant consists of fourteen Norman-Sigaudy double-ended boilers, which supply steam at a working pressure of 210 pounds to the square inch. It will be seen that she has unusual smokestack capacity, for not only are there four smokestacks, but they are of large diameter. Hence, the "Chateaurenault" should have no difficulty in realizing a natural draught horse power of 13,800. The contract horse power under forced draught is 23,000, and the corresponding speed is 23 knots.

The armament consists of two 6·5-inch rapid-fire guns mounted on the main deck, one forward, one aft, and protected by shields, each gun having a separate ammunition hoist; six 5·5-inch rapid-fire guns in sponsons on the gun deck, two firing dead-ahead and two dead-astern, and each protected by a circular shield; and ten 3-pounders and five 1-pounder rapid-fire guns mounted in commanding positions throughout the ship. For protection the vessel depends upon a steel deck which is 2¾ inches thick on the flat and 4 inches thick on the slopes above the machinery. There is also 2¾ inches of steel protection on the sponsons for the guns.

The "Chateaurenault" is designed for the same class of work as our "Minneapolis" and "Columbia," that of commerce destroying, and in order to prevent detection when she is searching for the merchant ships of the enemy, she has been made to conform, as far as possible, to the outward appearance of a modern trans-Atlantic steamer. Hence, there are no fighting tops on the vessel, and her masts and funnels are given the rake and trim appearance which characterizes the pole masts of a merchant steamer.

SOME PERSPECTIVES OF THE PARIS EXPOSITION.

Notwithstanding the amazing proportions of the Paris Exposition, the utmost perfection of detail has been maintained throughout. The casual visitor may look upon it as a mere agglomeration of beautiful, and, perhaps, fantastic buildings which have been erected for the entertainment of sightseers, but to the thoughtful it is something more than an ephemeral fairyland. It illustrates in the most elaborate manner possible the progress made by man during the last one hundred years in every department of art, science, and industry. It is a veritable epitome of the natural and industrial resources of the entire globe. The exhibition palaces are of vast size, and some of them are handsome, but others show that the too great facility with which staff can be worked, often results in rather meretricious decoration.

In the area between the Alma and Invalides Bridges, the nations have built a most bewildering series of palaces and pavilions and the effect produced by them is singular and pleasing. "Old Paris" adds a keynote of mediævalism and serves to link together the present and the past. The amusement sections are filled with interesting shows of a more or less serious nature, and the East adds a series of picturesque streets and squares. The Exposition authorities have endeavored to render the exhibition as complete as possible by inaugurating in each department retrospective and centennial sections in which the visitor can compare the past with the present and can form his own estimate of the wonderful advance since the time of Napoleon I.

There are forty-five entrances to the Exposition, but the visitor strolling down the Champs Elysées naturally comes first to the monumental entrance at the Place de la Concorde. This great gateway, designed by M. Binet, is, without question, the most criticised building that has ever been erected at this or any other exposition. It is familiarly known as the "Salamander," owing to its resemblance to a stove commonly so denominated. In its main lines it resembles somewhat a great wicker basket with long, curved handles, the whole affair being inverted and crowned by a female figure. It is painted blue, green and white, and the gilding is considerable. The front arch, facing the Place de la Concorde, is surmounted by M. Moreau-Vautier's startling creation. The figure is supposed to symbolize Paris, and is clad in the today's costume of a Parisienne. It terminates worthily the one conspicuous failure of the Exposition. The public enters through the great arch, and disperses by the two lateral arches, after passing through one of the seventy-six turnstiles. This arrangement is most ingenious, and permits of nearly one thousand people per minute entering the grounds at this point alone. The turnstiles are placed back to back in double rank.

The visitor, after entering the gate, finds himself in a vast pleasaunce extending from the Place de la Concorde to the Pont des Invalides, The space is admirably filled with thousands of plants and flowers. The visitor crosses the Avenue Nicholas II., which separates the two Palaces of Fine Arts and then passes down the Rue de Paris, along which are distributed the buildings of the city of Paris, the Horticultural buildings and the palace where the congresses are to be held. Directly across the Seine is the "Street of Nations," with the picturesque and interesting buildings. The Quai d'Orsay continues the "Streets of Nations," after passing the Pont de l'Alma, but the Pavilion of Mexico is the last of the national buildings. Then comes the Pavilions of Hygiene, the Navy and Military Pavilion, the Palace of Navigation, the Pavilion of Forestry, etc.

We now reach the Champ de Mars, the arrangement of which is much the same as it was in 1899, but the long buildings on either side are quite different in design from those of the earlier Exposition, and the masking of the façade of the Electricity Building by the enormous Château d'Eau is most successful. It is in the form of a gigantic grotto, in which at night a fountain of rainbow-colored water plays incessantly. In the center of the immense basin is a symbolical group representing Humanity and Progress. The Palace of Electricity lies directly behind this ornamental fountain, and in the rear of it are the sections of Agriculture and Food and the great Salle des Fêtes. The Palace of Agriculture was the old Machinery Hall, and it has been completely changed. The buildings on both sides of the Champ de Mars extend from the Electricity Building to the Eiffel Tower. On the right side, beginning at the Electricity Building, are the sections given up to mechanical industries, civil engineering, transportation, education, letters, science and arts. On the other side are the buildings devoted to mechanics, textiles, mines and metallurgy.

The Eiffel Tower forms a great entrance to the Champ de Mars and was, perhaps, one of the chief attractions of the Exposition of 1889, and is the loftiest tower in the world, being approximately 1,000 feet high. The tower weighs 16,000,000 pounds, and millions of rivets were used in its construction. It has been recently repainted, and 60,000 pints of paint were used for each coat. It is illuminated at night by 7,000 electric lights of ten-candle power each. The view of the Exposition from the top of the tower is most attractive, the bright colored pavilions, towers and terraces showing off to the greatest advantage, and producing an effect of confused architectural magnificence never to be forgotten, recalling in many ways one of the fantastical panoramas of Doré. At the base of the tower are various concessions and exhibits, such as the Tour de Monde, the Palace of Costumes, the Cinéorama, the Maréorama, the Grand Celestial Globe, and various panoramas.

Standing at the Eiffel Tower the view of the Trocadéro is most imposing. In 1878, the Palace du Trocadéro was considered a wonder, but it now looks dingy by contrast with the white and parti-colored plaster buildings in the gardens housing the colonial exhibits. There is enough of the East about the scene to produce a bizarre and delightful appearance.

The ensemble of the Exposition shows a variety of architecture which might be called "architecture de fête," and reminds one of the handsome façades and arches which Renaissance architects and painters were so fond of building on all gala days. The architecture is nowhere severe, color is freely used and sometimes becomes vulgar. The question may very reasonably be asked whether or not any part of the Paris Exposition is of as effective architecture as the "Court of Honor" at our own Fair of 1893. On the whole there is not, although certain parts of the Paris Exposition are very fine, the Seine particularly playing an important part, it being rather more picturesque than any feature of our own Fair. The natural beauty of the site has not been destroyed, the gardening is perfect and everywhere there is an evidence of taste and good judgment in decoration with the exceptions noted, and over the whole Exposition there reigns a holiday air.

AT the annual meeting of the American Academy of Medicine, Dr. Pyle referred to an article which appeared in a New York paper, entitled "Sleep Cure for Nervous Diseases." This cure consisted of eight grammes of bromine in a half glass of water every two hours. The paper also stated that the discoverer of this cure also maintains that rest—absolute prolonged rest—is the one thing which persons suffering from nervous disorders stand most in need of, and that they can obtain the rest through the agency of "bromine" better than any other way, says The Medical News. This only shows the great danger of medical advice which is given so freely in the daily papers. Bromine in an overdose acts as a corrosive poison and produces violent inflammation of the lips, mouth, tongue and œsophagus, with incessant burning pains followed in two hours and a half by prostration ending in death.

Engineering Notes.

In Siberia acetylene gas is largely used to light up various operations along the line where work is carried on at night.

The railway authorities of the Mexican government have been ordered to use certain safety appliances. All the passenger cars must be so equipped before the end of 1904.

Forty-one gas engines using blast furnace gas are working in Germany, the total horse power aggregating 21,950. The horse power of such engines in Belgium is 3,700, France 3,250, and England 2,060.

London is to have a new street, which will give a great thoroughfare north and south. The new street will begin at Theobald's Road, will cross High Holborn, and will finally reach the Strand by means of two arms which are limited by Somerset House.

The railway mileage of Europe has increased from 83,680 miles in 1875 to 167,439 miles in 1899. The increase has been the largest in Russia, amounting to no less than 15,142 miles; then comes Germany, 14,666 miles; and France with 12,990 miles; while England has added only 5,089 miles.

It is said that coal was mined prior to 1113. In the Liège district coal was first found about 1199. In 1214 coal was attracting some attention on the southern side of the Firth of Forth. This was a hundred years after the mines in the Worm district are said to have been opened and regularly worked. It is not likely that coal was mined in Great Britain before the thirteenth century.

The fire department of New York city has 94 engine and hook and ladder companies, and 1,375 officers and men in the Boroughs of Manhattan and Bronx, and the Boroughs of Brooklyn and Queens have 80 such companies and 1,029 officers and men. There are also 6 powerful fireboats in commission. The Boroughs of Richmond and Queens have a volunteer service of 1,725 and 2,000 men respectively.

A corporation has applied to Congress for permission to lay underground pipes in the streets of Washington, D. C., for the purpose of distributing cool air through the business buildings and residences of the city. The scheme provides for the erection of a refrigerating plant at some central point, from which cold air will be pumped for distribution through the system of pipes. The flow of cold air will be regulated in a manner somewhat similar to the measurement of gas, and can be turned on the same as hot air is turned on from a furnace.

The new engines of the Denver & Rio Grande Railway have iron pipes extending along the roof of the cab and connecting with the boiler. Through this pipe, without making a perceptible motion, says The Railway Review, either the engineer or fireman can send, under 200 pounds pressure, a jet of steam and boiling water that would effectually kill or injure anything living that happened to be on the tender or the front end of the baggage car. The blow-off cock thus arranged is expected to prevent train robbers climbing over the tender.

The West Shore Railroad Company recently had some litigation with a refrigeration company over a piece of land. The railroad company had a spur of track on the property, and when the refrigeration company began to drive piles for the foundation of its new building, the railroad company ran an empty box car upon the tracks and halted it in the line of the pile driver. The workmen proceeded to saw the car in two and throw off the piece that lapped over onto their property. The person, at whose instigation this was done was arrested, and a freight engine was backed upon the disputed property. The case was taken into court.

At the acetylene works which supply the gas to the Hungarian street railway, chloride of lime was formerly employed as the purifying material. They now use a mixture of chloride of lime and sodium plumbate containing an excess of alkali. Chloride of lime alone is likely to cause the explosion of the gas, on account of the liberation of chlorine. A purifier charged with a new mixture was opened after ten hours' working. When the upper grating, covered with lime, was removed, spontaneous combustion took place, and a long flame rose from the apparatus, but there was no explosion. Under these conditions, therefore, it is safe to say that the new mixture is not dangerous.

The administration of the Chinese Custom House has recently published its annual report, according to which the exterior commerce of China has been, in 1899, 460,000,000 of taels (the tael equals about 75 cents), this being an increase of 21,000,000 over 1898. The revenues of custom houses were 26,000,000, and increase of 3,000,000 over 1898. The exports have been 195,000,000, surpassing those of 1898 by 36,000,000, and the imports are valued at 264,000,000. The imports from America and Japan have given the greatest increase. The vessels which have entered in 1899 into the Chinese ports give a total of 5,479,000 tons, the figure for 1898 being 4,927,000. England represents 59 per cent of the total; China, 24; Japan, 7; Germany, 5; France, 2; America, Sweden and Russia, each 1.

Science Notes.

The Italian faster, Succi, has been declared insane and is confined in an asylum.

A solid train of twenty carloads of salt was recently shipped from Salt Lake City, Utah.

Prof. Loeb, of the University of Chicago, has made interesting experiments upon the artificial fertilization of the eggs of sea urchins, and the production of larvæ after an immersion of two hours in a solution of magnesium chloride and sea water. The sea water and the instruments were carefully sterilized.

The arrow poison of the Wagogo, is derived from the juice of the bark of two Euphorbiaceous trees by continued boiling. Briéger has isolated therefrom a crystalline body, which corresponds chemically and physiologically with the Wakamba arrow poison. The Euphorbia juice appears to act as a progressive poison.

The ninth volume of "Le Opere di Galileo Galilei" was recently published in Florence, and shows that he had an excellent appreciation for Italian literature. The six volumes include an address which he made on the topography and configuration of "Inferno." This was delivered before the Florentine Academy of Sciences.

A new developer has appeared, orthodioxybenzol, which, under the name of Elconal, is proposed by Dr. Ludwig Ellon. It has the singular property of allowing a mixture of hypo in all proportions, and a combined developing and fixing bath may be thus prepared. It is spoken of very highly by photographers who have used it.

Portugal was very liberal to scientific men at the time of the recent eclipse. The Custom House employes were ordered to give astronomers every facility for the entry of their baggage, their instruments being admitted free on the presentation of a certificate from an astronomical observatory countersigned by a Portuguese consular agent.

Rubber culture was first scientifically undertaken at the Botanical Gardens at Peradeniya, in 1876, by Dr. Trimen, and in 1897 Ceylon boasted of 250,000 trees of the Brazilian variety which yielded an amount of one pound and a half per tree, fifty trees being planted to the acre. It is fortunate for Brazil that very little of the East possesses the soil, climate and conditions necessary for such competition. The present tendency is now to introduce machinery and chemical processes in South America requiring more or less technical skill. Some companies are using centrifugal machines.

The walls of the Comédie Française, Paris, were found to have been severely damaged by the fire, and one of them needs practically to be rebuilt, while much has to be done in the way of strengthening the remaining three. The corridors and staircases are to be widened and the arrangement of the dressing-rooms is to be modified. The building will be lighted and heated on an entirely new system, and elevators will be provided both for the use of the public and the actors. The theater will probably be a model one, if the plans are carried out to a successful completion. It is not likely that the Comédie Française will be completed until the close of the present year.

The new developer, adurol, which is prepared in Germany, is increasing in popularity. According to the report of the Imperial College, of Vienna, it is superior to hydroquinone as a developing agent, and gives less fog. The image, developed in adurol, appears in five to ten seconds, as compared to forty seconds with hydroquinone; the development is completed in four to five minutes as against six to seven minutes with the latter. The finished image is also somewhat softer in tone. Prof. Vogel, the late eminent photographic authority of Berlin, and Prof. Bothamley, of London, are of the same opinion, and prefer the new developer to hydroquinone.

In Annam the number of persons who live mainly upon fish is estimated at five millions. The fishing industry has reached a considerable development in that country. The region most abounding in fish is that of the southern provinces, Binh-Thuan and Khanh-Hoa, and that of Thanh-Hoa in the north. The latter district supplies fish to the Tonkin markets and a part of China. The two former provinces, owing to the numerous bays where fishing may be carried on in all seasons, supply the salting establishments which furnish their products to Singapore and the extreme Orient. In other regions of the coast of Annam the supply of fish serves only to supply the needs of local consumption, and is even insufficient for this. As to river fishing, it is reduced to the needs of the inhabitants of the banks. The outfit of a fishing bark of small tonnage is four men and two children, and for the large sailing junks it consists of seven adults and three to four children. The number of persons engaged in the fishing and kindred industries in Annam has been estimated at 30,000, of which 6,000 are in Thanh-Hoa and 5,000 in Quang-Nam. In adding the women and children, this number may be carried to 60,000, representing the total number of natives who make their living from the fishing industry.

Electrical Notes.

The main lighthouse at Sandy Hook was struck by lightning on May 21, and its electrical apparatus was much injured; oil had to be used in the lamps.

Electricity is to take place of steam at the shifting tables of the 30-inch rolls at Homestead, Pa. The only part of the plant which will be operated by steam will be the big roll engines.

From April 15 to May 13, 799,479 passengers paid for using the moving sidewalk and the third-rail system in the Paris Exposition grounds. The greatest number of passengers carried in one day was 75,000, says The Electrical World.

Electric traction which the London Metropolitan District Railway have introduced upon their system between Earl's Court and High Street, Kensington, is giving satisfaction. The train consists of six coaches with a motor car at each end. The total length of the train is 245 feet, while its aggregate weight is 180 tons, and has accommodation for 312 passengers. The motor cars, with a rating of 800 horse power each, impart a mean speed to the train of 15 miles per hour, which is an increase of four miles upon the steam locomotive traction now in vogue. They can, if necessary travel at 20 miles per hour, and can attain that speed within 200 feet from starting and can be brought to a standstill in 130 feet which is only a little more than half its own length.

Mr. Richard Kerr, F.G.S., has been exhibiting to the members of the Royal Society in London his latest development of the Hertzian wave system. This is a clock, the movements of which are controlled from a distance by means of wireless telegraphy. The inventor proposes to be able simultaneously to adjust the whole of the clocks in London by means of this single timepiece. In order to render a clock sensitive to the waves he affixes to it a receiving instrument with a coherer. Then he establishes a transmitter at some point in the city, and by simply pressing a button every clock equipped with the receiver would be influenced, and the hands moved to any desired part of the dial. Not only would public clocks be synchronized in this manner, but the system might be extended to the timepieces in private residences as well.

The Postal department of the English government have commenced work upon the new telephone system with which London is to be supplied. Up to the present time the National Telephone Company have enjoyed a powerful monoply, but the system has proved so unsatisfactory, that in deference to public opinion the government have entered the field of competition. Many of the subways to carry the wires—the underground system is to be employed—have been designed and are ready for excavation. The area is officially designated "The London Telephone Area," and practically covers the same ground as that served by the private company. The government scheme when completed will cover an immense area of over 600 square miles, and it is expected that the major portion of the system will be in working order in about twelve months' time. The central exchange will be situated near the present Post Office Savings Bank, while subexchanges will be distributed throughout the area. Ladies will be engaged in the exchanges throughout the day, and men will attend to the same duties during the night.

Three large engines of 3,000 horse power have been furnished by Sulzer Brothers, of Winterthur, Switzerland, for one of the electric stations of Berlin; these are triple-expansion, with four cylinders. The two low-pressure cylinders, of 50 inches diameter, are placed side by side, with their axis 8 feet apart; their pistons each operate a crank upon the main shaft, these being placed 90° apart; and the two high-pressure cylinders are placed over each of these respectively, with common piston rods. The upper and lower cylinders of each pair are separated by a distance of 5 feet, so that the pistons of the latter may be taken out without difficulty. Three iron columns fixed to the lower cylinder support the upper; the stroke of all the pistons is about 4·2 feet. A strong foundation-plate supports the bearings of the main shaft, which has a diameter of 1·4 feet; the superposed cylinders are carried on one side by a detached supporting piece, and on the other by iron columns. The vertical air pumps are connected with the piston-rod of the low-pressure cylinders. The latter cylinders have steam-cushions, as the use of superheated steam is provided for. The distribution to all the cylinders is made by four-way valves, which are operated by horizontal shafts worked by a vertical shaft carrying the governor, the latter being connected with the main shaft of the engine by helicoidal gearing. The valves are placed in the bottom and top covers of the cylinders. The main shaft carries at each end a fly-wheel 19 feet in diameter; having also on one end the armature of the dynamo. The engines make normally 85 revolutions per minute, which corresponds to a piston-speed of 12 feet per second. The great height of these engines may be observed by the fact that the top of the upper cylinder is 35 feet above the axis of the main shaft.

Automobile News.

Two lines of automobile communication will be opened for traffic in the neighborhood of Corunna, Spain, during the present year.

The London publisher, Alfred Harmsworth, while touring in France, has counted in one day, on the Riviera, 177 motor carriages and 269 motor tricycles.

A private automobile stable will be built in New York city in the fall. In addition to the carriage house, there will be a room for charging the batteries and quarters for the men who will take care of the vehicles.

A close observer states that by actual count the number of automobiles in regular use in Paris represents two or three per cent of the traffic on week days, with a very much higher average on Sunday and holidays, probably reaching five per cent.

At Maritzburg, in Africa, traction engines have been pressed into service by the British military authorities for transport purposes, and on some occasions they have been used to haul wagon-loads of refugee children into the country to give them an outing.

The Innsbruck Motor Car Company intends to run motor omnibuses on the most frequented of the Alpine highways. The vehicles will contain seats for fourteen persons, and will be as comfortable as the usual mail coaches. They will first run on the route from Innsbruck to Partenkirchen and to Oberammergau.

The automobile which has been ordered by the Prince of Wales from the Daimler Company has been turned over to Messrs. Hooper, of St. James Street, who are now finishing the body of the vehicle; it is to be ready in the month of June. The general finish will be in the same style as that of the other carriages belonging to the Prince, and it will, no doubt, be one of the finest automobiles to be seen in England. The body is of the phaeton type, with several modifications. The Prince has already had a number of lessons in the art of automobile driving, and will no doubt take a prominent place among the amateurs of the sport.

James T. Allen, of the Patent Office, has compiled a "Digest of United States Automobile Patents, from 1789 to July 1, 1899, including all Patents Officially Classed as Traction Engines for the Same Period." They are chronologically arranged under general heads of spring, steam, gas, air, electricity, gearing, traction-engines and miscellaneous. All the drawings are exactly reproduced from the patents, together with the claims, and a complete list of references cited against patents while pending as applications, together with lists of patents in the class of portable engines, traction wheels, electric locomotives and electric railway battery systems. The volume is particularly valuable, owing to the fact that no drawings are omitted, every sheet being given.

One of the latest types of automobiles is the new Swiss vehicle made by the Mees Company, in the canton of Zurich. Its construction presents a great number of interesting points. The company uses in its large vehicles a gasoline motor of the type known in Europe as balancier. Its two pistons move in opposite directions in a common cylinder, placed horizontally, and the force of the explosion which takes place between them is transmitted by piston rods and levers to a shaft with double crank placed above the cylinder in the recipient of the motor. In consequence, the motor unites the advantage of simplicity possessed by the single-cylinder type to those of a two or four-cylinder motor, namely, quietness and ease of working. It avoids the shocks which occur with the single-cylinder type, as the cranks are placed at 180° apart. In the smaller vehicles, a two-cylinder motor is used, this being placed in front of the vehicle. To diminish as much as possible the consumption of water, the explosion chamber alone is cooled with water, while the portions of the cylinder on each side carry the usual radiation ribs. In the large vehicles, the motor is placed on the rear axle, and is covered by a case provided with a shutter, and inclosing the reservoir of gasoline, which acts at the same time as carbureter, and the water recipient. These two contain from 50 to 60 quarts, and for long trips an extra reservoir may be placed on or under the front truck. The water which is heated in the envelope of the motor cylinder is cooled by an exterior spiral tube with cooling ribs, and is brought back to the motor by a small rotary pump. The transmitting mechanism is of a novel type, and consists essentially of a gear-wheel mounted upon the main shaft, with which engages a pinion on each side, these engaging in turn with a toothed crown which surrounds the whole. The arrangement of the mechanism is such that when the motor runs empty, the pinions revolve around the inside of the crown, but when they are prevented from turning by stopping the disk upon which their axles are mounted, the force is transmitted to the central wheel. By this arrangement the motor is always in gear, and it is thrown on or off without shock. The speed-changing device provides for 7·4 and 74 miles per hour, and an extra device gives also 6 and 13 miles.

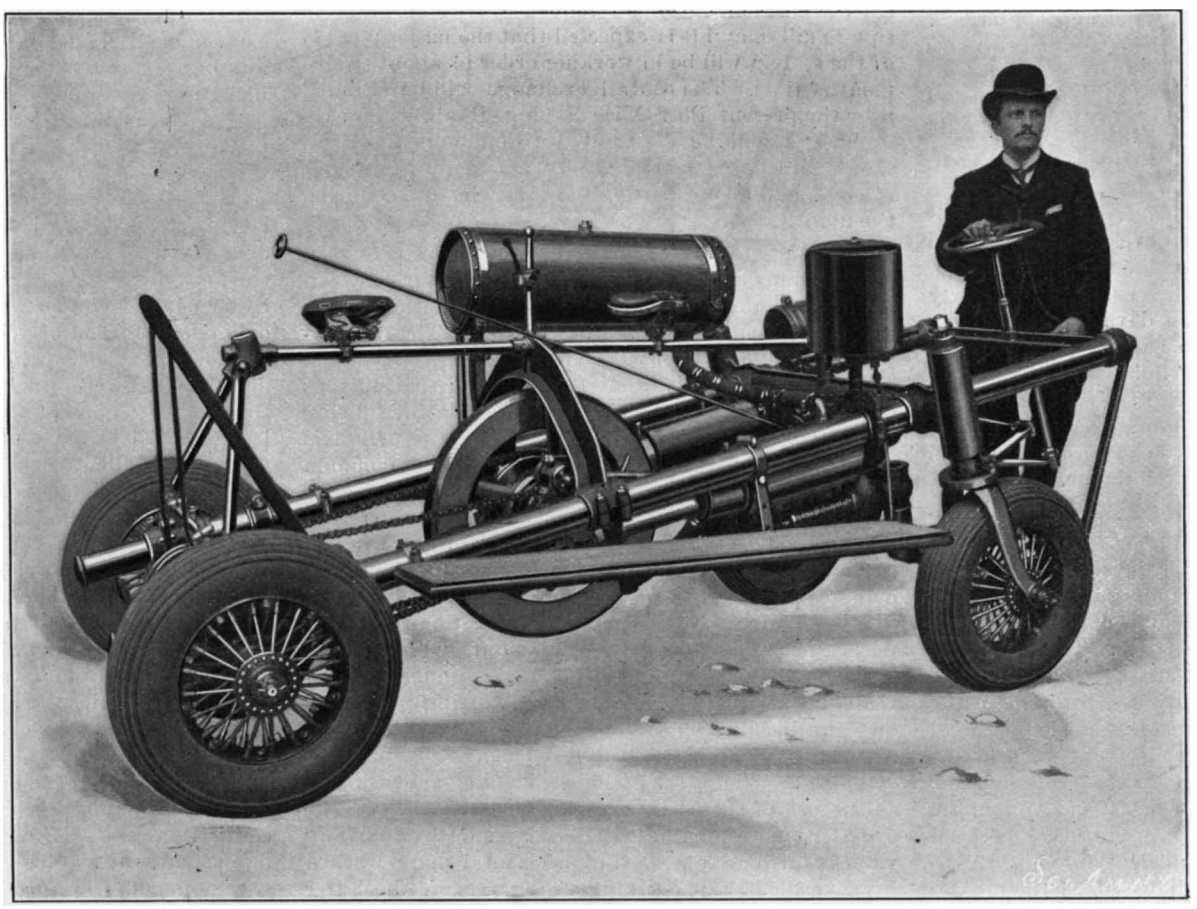
A MILITARY AUTOMOBILE.

The persistence with which the idea is advocated of utilizing the bicycle and the automobile in warfare, proves that the builders and users have full faith in the ability of these machines, not only to stand the tremendous strain of a military campaign, but to find a field in which they can give special and very suitable service. In a previous issue we illustrated the latest and probably the most successful attempt to utilize the steam traction engine in warfare. Generally speaking, such an armored train built for traveling across country, or on the roads, is an automobile, and as such it may be said to have proved that automobilism has a future before it in military operations.

The automobile herewith illustrated is a further attempt in this direction. The special field of operations for which the Pennington war automobile is designed is that of light artillery and the machine gun—more particularly the latter. It has been built with the idea of carrying a couple of Maxims or Colts with their detachment rapidly into action; and for this purpose it is provided with engines of exceptional power, and with a belt of armor not shown in the illustrations. It has been constructed with a low center of gravity, and its bulk has been reduced to the smallest limit consistent with the duties it is required to perform.

The framework of the machine consists of two longitudinal, 3-inch weldless steel tubes, to which the rear axle and the steering heads of the front wheels are firmly secured. The two main tubes and the whole framework are tied together with cross braces of manganese bronze, and with braces formed of a smaller diameter tubing. The crank shaft is placed in the middle of the frame at the point where the main cross brace occurs. A heavy flywheel is carried at the center of the shaft, and on each side of it and bolted to the main frames are two cylinders, 5¼ inches in diameter by 12 inches stroke, which are made of weldless tubing, and are water-jacketed. The cooling tank is carried on the front of the machine and serves the purpose of a wind-shield. Power is transmitted from the crank shaft to the driving shaft by means of two chains driven from either side of the flywheel. There are, as will be noticed from the engravings, gears for two speeds, the lower for hill climbing and for work on heavy roads, the other being a high-speed gear suitable to fast traveling on good roads. Changes in speed are effected by means of improved friction clutches which enable the gears to be thrown in and out without shock. The tank capacity, both for water and gasoline, is sufficient to enable these machines to run from 150 to 200 miles without replenishing. In order to secure thorough ignition, the motor is fitted with both electric and hot-tube methods of ignition. Leather covers are provided both above and below the running parts to protect them from mud and dust. It will be noticed from the engravings that the machine is well suited to the attainment of high speeds. Its center of gravity is very low, its bulk small, and its horse power unusually large, the latter being estimated at from 36 to 40 horse power. We are informed by the company that in a speed trial on a measured half mile of track, a rate of speed was attained of over a mile a minute.

It will be noticed in the engravings that the wheels because of the large diameter of the tires are well suited to rough roads. The wheels are 22 inches in diameter, the tires themselves are 5 inches in diameter. The total weight of the machine in working order is 1,500 pounds. As completed for war purposes, the machine will be covered on the front and sides with armor which will be proof against bullets, and except at close ranges, against fragments of shell. The machine will accommodate eight people; a steersman in front, a driver, who will occupy the rear seat, and a crew of six, seated three on a side above the footboards.



Cylinders, 5¼ inches diameter by 12 inches stroke; horse power, 36; wheels, 22 inches diameter; tires, 5 inches diameter; total weight, 1,500 pounds.

A MILITARY AUTOMOBILE.

Manila Women Lapidaries and Jewelers.

The lapidaries of our new Oriental possessions are the dark-skinned women of the Tagal tribe, who have acquired their skill and ingenuity in gem-setting from the artificers of Spain and Morocco. In delicacy of design and execution their work far surpasses that of their masters. Much has been written about the coral jewelry of Manila (pink coral necklaces, white coral pendants, and red coral rosaries like drops of blood), but the impression should not be gained that the lapidary art of the Manila women jewelers is confined to coral products. Pretty and characteristic as these objects of adornment are, they do not compare in value and beauty with the chains of woven gold, filigrees of silver, and pendants of pearls and garnets made by these women. Diamonds, amethysts, and similar stones are not so often met with in the native jewelry of Manila; but their rarity is not known, even though they are almost entirely lacking in the trinkets of the natives and foreigners in Manila.

Only native gems and minerals, such as garnets, black, yellow, and white pearls, coral, mother-of-pearl, and gold and silver, are utilized by the women jewelers. All of these island gems are found in the small shops of the native jewelers, and the manner in which they are worked up into ornaments of striking beauty and value attracts the attention of an American. A recent importation of many of these most popular Manila ornaments gives promise of their wide introduction into the United States. The specimens brought to this country, all the work of women artificers, show that the native lapidaries combine the ability of the Moorish gem worker with the patience of the Chinese and Japanese craftsman. Among these specimens are beautiful and exquisite earrings, necklaces, bracelets, chains, buttons, pins and brooches of every conceivable design. The chains are made of the most delicate strands of almost pure native gold, braided and woven like a piece of Manila hemp rope, with even the tiny threads imitated to perfection. So delicate and dainty is such a chain that one can hardly believe it possible that the women lapidaries beat out the rough gold and draw the gold wire without any of the modern implements used by Western gold beaters.

Hatpins of pure gold are made in the form of miniature Malay creeses with water lily leaves for handles. Breastpins and stickpins are often thickly studded with stones. Silver and gold filigree work, lacelike in appearance, is made with rare skill; other products of the women jewelers are necklaces and pendants of dainty gold ferns, flexible and yet strong, with every stem and vine veined exactly as in the original plant. Knives, brooches, and pocketbooks are cut out of mother-of-pearl, and thickly studded with green and red garnets. Black and white pearls are set in gold buttons and earrings. Like most of the Oriental craftsmen, the Manila lapidaries are expert in enameling, an art which they combine with their other work with excellent taste. The necklace may be of gold, enameled blue, and set with gray pearls, or of black enamel studded with red and green garnets. Few of these jewels are imitations. Nearly every woman lapidary strives to give an individuality to her work, and her products are proof of her success. The treasures of one shop can rarely be duplicated in those of another. Sometimes the conception may be a little crude and lacking in taste; but where there is one such example there will be a dozen that are perfect in every particular. The harmonizing of colors and combining of stones and metals show an instinctive taste among these illiterate Manila lapidaries which is difficult to explain. From the standpoint of the American jeweler there is much in the way of originality and perfection of design and execution that can be learned from these women of the Orient. In all the art they display something of the dark, sinister Moorish is always suggested, something that is felt in the abundance of Malay creeses, green and golden alligators, dragons, and knives of every design and color. G. E. W.

OWING to the high price of ebony the manufacturers of pianoforte keyboards have been searching for a long time for a cheap substitute with a grain close enough to take the necessary polish. At last it was found that our native dogwood could be stained, oiled and polished until it equaled ebony both in appearance and utility. The wood, which comes in all sizes, is sawed into strips an inch square and 8 to 20 inches long. The strips are piled up cobhouse style, out of doors, where they remain until thoroughly seasoned. The development of this industry has given employment to a considerable number of people, and has also permitted of the cutting of trees which were formerly considered to be of little or no value.

AT the 500th anniversary of the University of Cracow, an honorary degree was bestowed on Professor Simon Newcomb.

OSTIA, THE PORT OF ANCIENT ROME.

The subject of the trade of Rome is an interesting and important one. The metropolis of the ancient world at one time numbered about 1,000,000 inhabitants, and it was no small task to provision this city. Ostia, on the coast of the Mediterranean Sea, now about twenty-one miles by rail from Rome, was naturally the great entrepôt. It was settled in the second century after the foundation of Rome, by Ancus Martius, and soon became an important commercial town. Under Augustus it lost some of its importance, due to the choking up of the harbor by the Tiber. Christianity was introduced at an early date, and the Bishopric of Ostia, according to some accounts, was founded by the Apostles themselves. The early Popes were all consecrated by the Bishop of Ostia.

The Tiber at present washes down eight and one-half million tons of sand annually, and this gradual extension of the delta has left Ostia miles inland. The astronomer, Padre Secchi, and Prof. Lanciani have determined that the average yearly increase of the coast is about 19 feet.

The Tiber was a bad river to navigate, and while a man-of-war could easily get over the bar, owing to its light draught and great propelling power, merchantmen usually had to anchor outside and discharge their cargoes with the aid of lighters. The old Romans made no attempt to improve the harbor, which they could have done very easily, for vessels of 150 tons burden now reach Rome. In early times the vessels were towed up stream by oxen and buffaloes, tow-paths being provided for them. Navigation was not allowed at night, and the vessels had to moor at stations. Prof. Lanciani states that there were thirty of these stations between Rome and the sea. Vessels from Ostia often reached Alexandria in eleven days and Gibraltar in five days.

At Ostia the warehouses covered one-half of the town, which was two miles long and one mile wide. The city of Ostia must have presented a splendid appearance, as it contained fine temples, theaters, and villas of patricians, and the ruins were so extensive that for five centuries the villagers burned marble for lime without exhausting the supply; and when Poggio Bracciolini visited Ostia with Cosimo de' Medici they found the villagers occupied with burning an entire temple into lime. It is sad to contemplate the loss of so many antiquities, for the rude peasants burned wall facings and statues alike.

Our engraving represents the warehouses along the so-called "Street of Wharfs." The floors are raised three feet above the pavement to facilitate the loading of carts. On the opposite side the ruins seem to belong to the private houses of merchants, the ground floors and basements being used for storage purposes. One of the rooms is in excellent preservation. It is 36 feet long by 28 feet wide, with six rows of large earthern oil jars 4 feet in diameter, each marked with its capacity. Another store belonging to the same house is vaulted over and has two circular openings for light. The barrack of the firemen (*vigiles*) and constables is one of the important ruins of Ostia. These men were numerous, as frays and fires are very apt to occur where large bodies of lawless sailors are congregated.



ENTRANCE TO WAREHOUSES IN OSTIA.

Our first engraving shows a portion of one of the warehouses, and it may also be seen in the middle of the second engraving. It gives an admirable idea of the solidity with which the Romans built all constructions of this kind. Through the arch to the left may be seen the concrete which was faced with what is known as "*opus recticulatum*," where the stones were carefully cut so as to present a square or lozenge-shaped end, and are fitted very closely, one to the other. These little blocks are about 3 inches square and are arranged to run in diagonal lines; the angles of the wall have neatly worked quoins with the inner end pointed so as to work in with the small lozenges. The effect of this sort of facing is very neat, but its beauty seems to have been very largely concealed by stucco. The front walls of the warehouse were built of brick which average 1 foot 11 inches square. The voussoirs are also of brick and the pediment and entablature are admirably handled. The engraving is interesting as showing Roman methods of construction, and also as showing how well the Romans built, even where the structures were used for such ordinary purposes as warehouses.



OSTIA, THE SEAPORT OF ROME—THE PRINCIPAL STREET AND WAREHOUSES.

At the beginning of the empire, Rome had a population of a million, and the necessity of building a better harbor than that of Ostia, which was rapidly filling up, became evident. Claudius built a new harbor two miles up the coast of Ostia. It was inclosed by jetties; the area of the harbor was about 6,200,000 square feet, and the quays were

over a mile long. The breakwater was constructed with the aid of caissons. The huge ship by which the Vatican obelisk was brought from Egypt was filled with concrete until it sank, then it was strengthened with rocks until it was above the level of the sea, when it was crowned by a lighthouse. The Emperor Trajan, in A. D. 103, founded Porto, as the harbor constructed by Claudius as a substitute for that of Ostia had soon shared the same fate. Trajan constructed a new canal, which now forms the main arm of the Tiber. Trajan's port is now two miles inland, and is a shallow lake surrounded by ruins. It resembled in every way a modern port; it was hexagonal in shape, and the basin communicated with the Port of Claudius. Trajan's harbor is one of the most interesting works of Imperial Rome.

Egypt alone shipped 190,000,000 bushels of grain to Rome, and Sicily, Sardinia, and other places poured in their enormous supplies of foodstuffs. In addition to this may be reckoned the vast quantities of building materials, especially marble, which were imported. The Claudian harbor was also used as a great naval station, and here was also the central post office for foreign correspondence. In modern times harbors have been constructed on even a larger scale than the three harbors mentioned, which successively served to receive the great ocean-borne commerce of Rome, but none of them ever possessed the same magnificence.

IN addition to the discovery of the mummy of King Menepthah, the "Pharaoh of the Exodus," there have been other remarkable discoveries. The season was a productive one as regards exploration in Egypt. M. Legrani, while setting up the fallen columns of the temple, came upon a city gate, the first that has been found in Egypt; it is of great height and is made of large blocks of squared limestone and is double, having one gate within another. Two chariots could easily pass through it abreast. It was built by Amenhotep II. of the eighteenth dynasty. The Exploration Fund has been restoring the temple of Der-el-Bahari at Thebes, and one day while Mr. Carter, the inspector of antiquities in Upper Egypt, was riding up to the door of the house occupied by the excavators, he noticed that his horse's hoofs sank in a hole in the ground. Further investigation brought to light under the house the entrance to a large tomb of the eleventh dynasty in a perfect state of preservation.

Correspondence.

"The Armor-Plate Fiasco."

To the Editor of the SCIENTIFIC AMERICAN:

Your article on page 370 on "The Armor-Plate Fiasco" is true in every word; not only that, but because of the foolish acts of Congress, the government has laid itself liable for more than half a million of dollars damages to the contractors for detention of their work and delay in delivering their ships.

The Cramp firm already have a large claim against the government for just such detention on account of non-delivery of armor, and they will collect it too, not at this Congress or the next probably; but it will be collected. *Vide* the large collections made by the contractors of the Civil War, and the claims for damages for all the present contractors are much more meritorious than any of those of the Civil War.

And from the expenses of navy yard work, no one believes that the government can manufacture armor for less than $1,000 per ton.

Then, again, how about the up-keep of the establishment when we do not need armor?

JOHN R. THOMAS.

Washington, D. C., June 15, 1900.

Removing Foreign Substances from the Eye.

To the Editor of the SCIENTIFIC AMERICAN:

A simple way of removing cinders or any foreign substance from the eye, is to gently hold the eye open with the fingers and thumb of one hand, while with the other hand to dash light handfuls of water in and across it, so as to produce a current of water flowing over all the surface of the eye, and the under side of the lids. The effect of this almost invariably is to push the intruding object from the eye.

This simple method should not be mistaken for washing the eye or immersing the face in water and opening and shutting the lids. Any misdirected help often tends to imbed an object so that the removal is difficult.

The eye should not be rubbed or one lid drawn over the other, or a silk handkerchief drawn across the affected part, but the eye should be kept from winking as much as possible while prompt action is being taken to cause a current of water to pass over the surface of the ball.

This method is a copy from nature, for when very fine dust enters the eye, nature seeks to relieve it by means of the fluids which moisten and lubricate the eye; and when larger objects enter, and cling more tenaciously, the irritation causes a copious discharge of tears so that the eye overflows, as nature tries by flushing it to propel along and float away with the current the cause of the irritation. M. T.

Springfield, Mass., June 16, 1900.

[Our correspondent's advice, while excellent, will not, we think, answer in all cases. In turning metal on a lathe, chips are very apt to fly into the eye with considerable force, producing painful, if not serious, wounds. To add to the difficulty the chips are often hot. Water would hardly tend to dislodge foreign particles of this kind. It is also essential to have clean water for flooding the delicate tissues of the eye. Chips of metal in the eye are of such a serious nature that many eye hospitals have most powerful magnets for use in removing the chips.—ED.]

The Current Supplement.

The current SUPPLEMENT, No. 1278, has many articles of unusual interest. "The Mount Prospect Laboratory" describes the chemical and biological laboratories for the examination of Brooklyn (New York) drinking water. The various forms of apparatus for collecting samples are illustrated, as well as the portable ice chest for transporting the bacteria samples. "The Duddell Oscillograph" describes a most ingenious electrical testing instrument. "Liquid Air as a Means for the Manufacture of Oxygen" is by Prof. Henry Morton. "The Palaces of Fine Arts of the Exposition of 1900" is accompanied by two large engravings. "Hot Water Heating from a Central Station" is by H. T. Yaryan.

Contents.

(Illustrated articles are marked with an asterisk.)

Armor plate fiasco 410
Automobile, military* 408
Automobile news 407
Books, new 411
Cruisers, high speed foreign* 405
Electrical notes 407
Engineering notes 406
Expansion, commercial 402
Eye, removing substances from 410
Fire-ladder, self-launching* 404
Heavens in July 403
Inventions, index of 411
Inventions recently patented 410
Lapidaries and jewelers, Manila 408
Liquid air fallacy 402
Military automobil*e 408
Notes and queries 411
Ostia* 409
Paris Exposition* 401, 406
Roads, good 402
Science notes 407
Supplement, current 410
Valve radiator* 404
Water, drinking, examination of* 404
Woodward, R. S.* 403

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

RIDING-CULTIVATOR.—DANIEL V. FORSBERG, Laurel, Neb. Each shovel-beam of this riding-cultivator can be quickly and conveniently adjusted by the hands of the rider, either to be raised or to be shifted sidewise. The shovel-beams can be vertically adjusted at their forward ends and held in adjusted position, enabling the beams to be set so that the shovels will enter the ground to a greater or less degree.

MECHANISM FOR OPERATING CUTTING APPARATUS OF MOWING-MACHINES.—JOHAN A. DAUGAARD, 1 Helgolandsgade, Copenhagen, Denmark. Contrary to the usual custom, no cog-wheels are used for transmitting the motive power from the axle of the machine to the connecting-rod actuating the knives of the cutting apparatus. A driven wheel has an undulated periphery engaged by two of the arms of a three-armed lever, the third arm being provided with a socket in its end, by which a pin carried by a lug is received. A crank-lever has one member connected with the lug, the other member being connected with a pitman operating the cutter-bar. By regulating the length of the arms, the necessary movement of the knife can be obtained, even with very flat waves upon the rim of the driven wheel.

WEEDER.—LOUIS J. KLINGER, Dufur, Ore. This weeder comprises a short main frame attached to an axle. A draft-tongue is extended in front and rear of and beneath the frame, and is flexibly connected therewith. A cross-beam is rigidly attached to the rear end of the draft-beam and is provided with plows or scraping devices. The construction relieves as much as possible the strain put upon the draft animals and enables the weed-cutters to be readily raised or lowered.

Electrical Apparatus.

ELECTRIC-BATTERY ATTACHMENT.—HENRY B. WARE and CHAUNCEY C. CORNELL, Wymore, Neb. This invention provides an insulated tray to be placed between the elements of a gravity-battery to catch any particles that may fall from the upper or zinc element, thus preventing waste and the oxidation of the copper element, and maintaining an equal internal resistance of the battery and a uniform electromotive force.

TROLLEY.—JOHN H. WALKER, Lexington, Ky. The inventor has devised a simply-constructed trolley-harp and efficient means for catching and directing a trolley-wire into the groove of a trolley-wheel. Protracted cold weather will be but a slight impediment to the practical working of the device, for the exposed surfaces and bearings are so arranged as to afford ice but little opportunity to accumulate in the joints. The trolley-harp and catch device not only prevent a large percentage of the wear and tear of the wire and wheel, but also obviate the occasional expense caused by the pulling down of the wires and breakage of suspension-poles.

ELECTRIC RAILWAY.—AUGOST CASAZZA, Hoboken, N. J. The invention relates to a class of electric railways in which the cars or trains take their supply of electricity from a sectional power-conductor, the sections of which are successively connected with the live wire as the car or train passes over them. In Mr. Casazza's arrangement, a second sectional conductor is employed together with switches, each of which is connected in series with two adjacent sections of the second or switch conductor and controls the connection of the power-conductor sections with the feeder. In applying this system to overhead conductors, the inventor employs a special construction of supporting plates for the sectional conductors.

Engineering Improvements.

VALVE-GEAR FOR GAS-ENGINES.—CHARLES WERNER, Pine Grove, Penn. A spring-closed air-admission valve is employed, to which an arm is secured, provided with a catch. The catch is engaged by a hook carried on a rod reciprocated from the engine. Devices are controlled by the exhaust-valve-operating mechanism, whereby the engagement of the reciprocating rod with the air-admission valve is controlled and made to follow the opening of the exhaust.

Mechanical Devices.

FLOUR-BOLTER.—FREDERICK W. BROWN, Lee Bell, W. Va. The inventor arranges the bolting-chambers in triangular form, suspends them from the angles of the triangle, and locates the operating mechanism in the space formed by the chambers. Thus a compact bolter of great capacity is produced, which can be easily balanced to secure a uniform, gyratory motion without any backlash. Provision is made for supporting three bolting-chambers from three links and equally distributing the weight on the links. A portion of one chamber is made to serve as a housing for the cut-off of the adjacent chamber, when the cut-off is withdrawn from over its bolting-cloth.

FAN ATTACHMENT FOR ROCKING-CHAIRS.—FRANCIS C. and GEORGE E. MERTZ, Port Chester, N. Y. The object of the invention is to produce a device which is attachable to any rocking-chair and which is adapted uniformly to rotate a set of fans mounted to turn upon the chair. The result is secured by the insertion of a spring between the operating mechanism and the fan, the spring being wound up by the rocker and running down as the fan-carrying shaft is turned.

FUEL-PRESS.—GEORGE W. MURPHY, Northfield, Minn. This press is designed to press straw into compact form for use as fuel. The apparatus has a spirally-threaded conical compression-chamber at the large or receiving end of which a plunger is mounted to reciprocate, serving to force the material to be compressed longitudinally into and through the compression-chamber. The thread of the compression-chamber serves to turn the material to be compressed, causing it to be rolled into compact form.

SPEED-GEARING.—ABRAHAM A. A. LEVIN, Manhattan, New York city. By means of this simple gearing the speed of an operated machine or device can be gradually increased over the speed of the driving-engine, thus saving steam. A series of independent main crank-shafts are employed, on each of which a gear-wheel is mounted. Supplemental and independent crank-shafts are also employed. Connecting-rods join the cranks of opposite crank-shafts. Pinions on the auxiliary crank-shafts engage with the gear-wheels on the first-named crank-shafts. On a power-shaft, gear-wheels are longitudinally movable to engage the pinions. By this device three separate machines can be operated.

WIRE-TIGHTENER.—JAMES P. HADDIX, Mena, Neb. The wire-tightener comprises a frame having a notched segment and feet for engaging a fence-post. An angular lever is fulcrumed on the frame and has forked members. Notched bars are pivoted to the forked members of the lever and are adapted to extend on opposite sides of a fence-post. A pawl is carried by the lever and engages the notched segment in tightening the wire.

CAN-FILLING MACHINE.—DAVID F. BALDAUF, Eden, N. Y. On a frame, shafts, geared together, are mounted. Cams are extended on the shafts in opposite directions and are designed to move frames at the ends of the machine. A tray holds the cans to be filled; and a hopper feeds the material. The beans or other material are placed in the hopper. When motion is imparted to the shafts, the tray and hopper are rocked up and down alternately at opposite ends. This movement will cause the material in the hopper to spread out evenly and pass into the cans.

COMBINED LATCH AND LOCK.—LEWIS C. WETZEL, Bellefonte, Penn. This invention provides a novel gravity-operated lock, so constructed that the sliding latch-bolt serves as a locking-bolt which can be operated only from the outer side of the door by a suitable key. The lock can be cheaply constructed and is efficient in operation.

MACHINE FOR UNDERMINING COAL.—ANDI OCHTINSKY, Rockvale, Colo. This invention relates to mining machines and provides a portable machine adapted to be operated by hand and capable of easy shift laterally and in an advanced direction as the picks undermine the coal. The invention consists in special forms of devices for feeding the machine forward and for turning it laterally, and in other details of construction and arrangement of the parts.

TURBINE WATER-WHEEL.—JOHN W. TAYLOR, York, Penn. The object of the invention is to improve the construction of that class of turbines which receive the water upon the upper part of the buckets through stationary chutes surrounding the wheel, the admission of water being controlled by means of an annular or cylindrical gate, adjustable to open or close the water-inlets or chutes. The inventor provides a gate which is adapted to open downward and close upward, so that water is admitted at the top of the wheel, to produce the greatest effect practicable before being discharged from the wheel.

Miscellaneous Inventions.

WATER-COCK.—JAMES P. BENTON, 167 Second St., Dalles, Ore. The invention relates to water-cocks and faucets, intended for out-door purposes. The construction of this mechanism permits of the automatic bleeding or venting of the water of a stand-pipe. This is readily and completely effected without siphoning the water in the hose back through the stand-pipe. It causes the bleeder to be put into action by the stand-pipe instead of by keys, thereby venting the pipe every time the water is shut off.

THILL OR POLE COUPLING.—ALBERT H. FORSYTHE, Sarcoxie, Mo. Mr. Forsythe, in this invention, improves upon a former coupling. He combines the several parts so that they can be conveniently applied to any axle, and so that the shaft can be coupled to or uncoupled from a vehicle with less trouble and greater rapidity than heretofore. All rattling is completely prevented. The coupling comprises a clip, having cheeks which receive the knuckle of the pole. The clip has an attachment consisting of side pieces. A pin is secured to one of the pieces, the opposing piece being arranged for locking with and disconnecting from the pin. In pivotal contact with a locking and an opposing side piece, is a connecting bar. This bar carries a spring, the free end of which extends transversely below the pin.

PORTABLE BUILDING.—JOHN C. KARR, 1020 East Ravenswood Park, Chicago, Ill. By this method a light, portable building can be constructed so as to be quickly set up and taken down. The foundation comprises a plurality of sections with mitered ends where they meet at the corners and square abutting ends where they meet along the sides or ends of the building. Cast plates bolted to the wooden foundation have semicircular upward projections at the section joints, and other plates have circular projections secured to the foundation with bolts, which have hooks at the end to catch brace wires. An angle iron on each section receives siding, so that when the pipe-posts are set in the projections, the pieces are fastened together. This supports the siding, posts and roof on the foundation.

ACETYLENE GAS GENERATOR.—WILLIAM BURROWS MINOR, Deposit, N. Y. The operation of the apparatus is automatic. Arranged to prevent waste of carbid, the apparatus permits a ready recharging without danger of the escape of gas into a room, or without interruption of its generation. A supply-pipe and a series of generators are arranged to receive water; valves are adapted to govern the supply. Floats in the generators open and close the valves. A locking device at all the generators except the last, automatically holds the respective valves in position, and a connection between the locking devices and the float of the last generator allows the former to release the valves when the float is raised.

VENTILATOR.—CONRAD J. VOLLMER, Lafayette, Ind. The ventilator or grate in this device has a frame. Slats terminating at their upper ends below the top of the frame form a space between the frame top and the upper ends of the slats. The grate has a cover provided with slats for covering the spaces between the slats of the grate. It is free to move transversely through the space formed between the frame top and the upper ends of the grate slats. Lugs on the cover abut against the frame top to hold the cover in a nearly horizontal position. The ventilator is for use on buildings, and permits the passage of air to or from the part to be ventilated; or, allows its exclusion in winter time or during rainy weather.

HYDROCARBON-GENERATOR.—FRANCIS M. BAKER, Lomira, Wis. The device embodies novel means for regulating the generation of the vapor, by transmitting to the retort the necessary heat. The transmission is through separate conducting parts which are in contact to transmit the heat, and which upon being moved out of contact cease to pass the heat. In this way the generation of vapor is stopped. A wick feeds the oil or alcohol to the retort by capillary attraction instead of by gravity air-pressure.

ARITHMETICAL SLATE.—HARRY CLAUD SEILER, Milton, Penn. A slate-frame, a slate therein having

sight-openings spaced apart from it, and disks arranged between the bearing-bars and the slate, and made to expose portions of their surfaces through the sight-openings in the slate, together with pulleys and gearings for operating the disks—these comprise an apparatus for use in teaching and drilling in primary arithmetic, whereby problems in addition, multiplication, subtraction, and division can be quickly and accurately indicated.

CUFF-HOLDER.—LOGAN CUMMINS, Memphis, Tenn. The arrangement of this mechanism furnishes a convenient attachment to a coat-sleeve at any needed point of its length for bringing the cuff into the desired position relatively to the sleeve. The construction permits an easy attachment or detachment of the holder from the cuff. A spring-clasp engages the inner edge of the cuff, a spring attaching device having prongs to engage with a sleeve, and a link for connecting the spring attaching device with the clasp.

TAILOR'S SQUARE.—DOMENICO SEBASTIANO, Manhattan, New York city. This square has two blades. One is used for getting the position of lines extending across a pattern and which locates certain positions upon the garment, such as the bottom of the arm-opening and the waist-line. The other is laid out with groups of marks arranged in plural series, the groups of each locating points upon the cross lines on the other blade of the square. The marks of each group are so disposed with reference to the corner-angle of the square as to place corresponding patterns of different sizes.

SUSPENSORY BANDAGE.—ALFRED CHARLES MOSS, Streator, Ill. The harness supporting this bandage is suspended from the shoulders instead of from the customary waist-line. It can be worn without discomfort or irritation. Metal buckles or fastening devices are not required; so that the fastenings employed are flexible, readily adapting themselves to the body and permitting an effective adjustment to the person. There are two loops connected at the back by straps, one of the loops being provided at its lower end with an extending tape, and the other with a series of longitudinally-arranged loops with which the free end of the strap or tape can be interlaced.

MANDOLIN-CITHERN.—FREDERICK MENZENHAUER, Jersey City, N. J. In this instrument the strings are sounded by means of picks, so that a tremolo or mandolin effect is produced. The picks are actuated by keys depressed by the fingers of one hand, while the other hand or a separate motor yields the power necessary to vibrate the entire pick-carrier, the speed of which will be such that the strings will be sounded two or three times before the key is released, so that a sustained tremolo impression is produced. By turning the handles at varying speeds, a changing degree of tremolo is obtained. The cithern has a keyboard extending across the strings.

TOY MAN-OF-WAR.—MORTON E. CONVERSE, Winchendon, Mass. The construction makes this toy virtually an ironclad, the hull and turrets or mountings for the primary battery being of metal. The sponsons, ports, and guns of the secondary battery are offset from the hull by embossing their parts, the guns of the primary battery being detachably mounted in the upper or deck structure. There is a wheeled support for the toy. The hull is hollow and open at the bottom, whereby all the parts can be stored away in the hull, together with the wheels. This enables the toy to be easily packed in a small compass and shipped without danger.

LIQUID-AIR CONTAINER.—JOHN SPRATT WRIGHTNOUR, Oil City, Penn. This device is for the economical utilization of liquid air in hospital wards, residences, auditoriums, etc. It consists of an open cup for liquid air, situated in the middle of the floor of a chamber or reservoir made of thin heat-conducting materials to contain the gases evaporating therefrom. The reservoir filled with these evaporated gases, with its frost-covered surface, will make an excellent cooler for the room. There are outlet-pipes controlled by cocks for the issue of the evaporated gases. By proper manipulation, some of the oxygenated liquid air in the cup is permitted to flow out on the floor and wall of the reservoir to evaporate, highly oxygenated air being thus obtained. The liquid air left in the cup is retained for later use as desired, evaporation therefrom being retarded by insulation by the cold air above it.

CUT-OFF VALVE FOR HYDRAULIC ELEVATORS.—PHILIP F. CANTLION, Manhattan, New York city. The inventor has devised a valve for automatically cutting off the water-supply to the pressure-cylinder, should the elevator move too far upward, and to retard an outflow of water should the elevator move too far downward, thus preventing accidents should the ordinary valve mechanism become inoperative.

PIPE-FASTENING.—JOHN M. SPEAR and WINNIE R. STRAW, Plainfield, Wis. By means of this device, the diameters of pipes, thimbles, or elbows can be adjusted so that they can be readily made to fit the parts with which they are to be used. The pipe is split longitudinally and has a part of one edge formed with a lap turned outward and laterally and extending a part of the length of the pipe. The pipe has at its other longitudinal edge a lap extended inwardly and latterly throughout the length of the pipe. The laps are inter-engaged. The pipe has its side edges fastened rigidly together throughout the length of the first-named lap, leaving the edges at one end free. The two parts of the pipe can be relatively moved to adjust the diameter.

Designs.

BELT.—LOUIS SANDERS, Brooklyn, New York city. The leading feature of this design is found in a peaked frontispiece, connecting the ends of a back section. A ring or chain ornamentation is provided for the frontispiece.

GARMENT-REGULATING ATTACHMENT FOR BELTS.—LOUIS SANDERS. Brooklyn, New York city. The attachment consists of a small plate, the formation of whose body includes a lower transverse section and upright sections connecting with the end portions of the transverse section. A corresponding flange is formed at the bottom of the transverse section. The attachment is easily adjusted and performs its functions efficiently.

NOTE.—Copies of any of these patents can be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal.

Marine Iron Works. Chicago. Catalogue free.

For logging engines. J. S. Mundy, Newark, N. J.

"U. S." Metal Polish. Indianapolis. Samples free.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Most durable, convenient Metal Workers' Crayon is made by D. M. Steward Mfg. Co., Chattanooga, Tenn.

Machine Work of every description. Jobbing and repairing. The Garvin Machine Co., 141 Varick St., N. Y.

Ferracute Machine Co., Bridgeton. N. J., U. S. A. Full line of Presses, Dies, and other Sheet Metal Machinery.

Quick-Firing Gun—How to make a model. Scale drawings and full particulars. Nos. 29, 30. 16 cents. Model Engineer, 12 Cortlandt St., New York.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7905) B. G. J. writes: 1. In a spark coil for a current of 98 volts and 50 amperes, what would be the size of the insulated wire, of the short wires forming the core? A. You may make your spark coil with a core of No. 14 iron wires cut 12 inches long, and annealed by heating red hot. The core should be about one inch diameter. Upon this wind the coil, insulating each layer with brown paper. Use No. 12 copper magnet wire, double covered with cotton. Six layers should give a good spark; more can be put on, if necessary. 2. What is the formula for birdlime? A. For birdlime boil the middle bark of the holly, gathered in June or July, for 6 or 8 hours in water, until it becomes tender; then drain off the water, and place it in a pit under ground, in layers with fern, and surround it with stones. Leave it to ferment for two or three weeks, until it forms a sort of mucilage, which must be pounded in a mortar, into a mass, and well rubbed between the hands in running water until all the refuse is worked out; then place it in an earthen vessel, and leave it for four or five days to ferment and purify itself. Remarks: Birdlime may also be made from mistletoe berries, the bark of the wayfaring tree and other vegetables, by a similar process. Should any of it stick to the hands, it may be removed by means of a little oil of lemon bottoms or turpentine. Use: To rub over twigs to catch birds or small animals. It is said to be discutient when applied externally. 3. Has any number or numbers of the SCIENTIFIC AMERICAN directions for making spark coils, motors or dynamos? If so, what number? A. We have published the plans and descriptions of many dynamos and motors. See SUPPLEMENT, Nos. 161, 600, 641, 759, 761, 783, 844, 865, 720, 793, 1202, 1210. And for coils, see SUPPLEMENT, Nos. 160, 569, 1087, 1124. Any or all of these can be sent you for ten cents each by mail.

(7906) T. L. C. writes: Suppose a cannon was placed perfectly level. When fired, would the ball rise when it left the muzzle or would it commence to drop the instant it left the gun? A. Gravity acts constantly, and the ball commences its downward curve at the instant it leaves the gun.

(7907) O. S. writes: I intend to erect lightning conductors at my buildings; they will be made of two-inch tubing below, reduced to one inch at the top, connected by a heavy copper wire running from the top, of one conductor to the other above the building. A. With reference to lightning rods we advise you to buy our SUPPLEMENT, No. 998, price 10 cents, which will give you much information upon the matter. 1. How high above the building should the conductor and wire be and how far away from the buildings should the conductors stand? A. The conductor should be carried to all high points of the building, and not merely to its highest point. It is not wise to erect very tall pointed rods projecting several feet above the roof. The conductor should be next the building and not stand away from it, and all metallic masses, such as water spouts, should be connected to it; though all authorities are not agreed in regard to this point, the latest opinion is in this direction. 2. Would lead joints do to connect the tubing with, or should the joints be iron? A. Connections may be soldered, riveted or screwed. In whatever way the parts are joined, the joint must be firm. 3. Would four feet in the ground with a lot of old iron at the bottom of the conductors be all right? A. If the ground is permanently wet, yes. The moisture of the earth is the important element, and not the depth. The rod must extend to water, no matter how far that is. 4. Will wood do to hold the wire and conductors to the building, or should I use glass? A. Opinions vary upon this point. We are inclined to think a wooden fastening is as good as any. 5. Will it do to put the ends of the wire inside the tubing at the top and drive a plug in tight? Would this make a good connection? A. No. What has been said above regarding connections, answers this question. Nor should you change to a copper wire. Copper is not considered to have any advantage over iron. A galvanized iron telegraph wire is sufficient if carried liberally over the roof and all high parts of the building. Nor is a two-inch pipe desirable. A one-inch pipe is entirely sufficient. Size is not important. Lightning often leaves a heavy rod and takes to a fine wire on its way to the earth.

NEW BOOKS, ETC.

DIGEST OF UNITED STATES AUTOMOBILE PATENTS FROM 1789 TO JULY 1, 1899. Including All Patents Officially Classed as Traction Engines for the Same Period. Compiled by J. T. Allen, Examiner United States Patent Office. Washington, D. C.: H. B. Russell. 1900. Quarto. Pp. 700. Sheep. Price $25.

The compiler has performed a difficult task with great credit to himself. He has previously compiled a digest of patents for cycles and velocipedes which has been of the utmost possible use, also of seeding machines and implements, plows and attachments, cultivators and wheel plows. All the patents relating to horseless vehicles are included in the portly volume. The patent drawings are reproduced photographically and no drawing is omitted, every sheet being given, which is most important to those who are engaged in inventing along the line of automobile vehicles. The remaining portion is a reproduction of essential descriptions of the inventions, with claims in full, with full data as to the patent, and further there is furnished a complete index to the references cited against the patents while pending as applications by number, name and date, and also the interferences, if any, the parties thereto and the decisions. The index is alphabetical. The patents are arranged chronologically under the heads of spring, steam, gas, air, electricity and gearing, while under the head of traction engines are given all traction engine patents as officially passed upon. There are various indices adding to the value of the book. The automobile patents are continued from July 1, 1899, in the United States Electrical Weekly, which is also compiled by Mr. Allen.

THE GENESIS OF WORLDS. By J. H. Hobart Bennett. Springfield, Ill. 1900. 12mo. Pp. 345. Price $1.65.

SYSTEM OF MEASUREMENTS ADOPTED BY THE NATIONAL ASSOCIATION OF MASTER HOUSE PAINTERS AND DECORATORS OF THE UNITED STATES. New York: The Painter's Magazine. 1899. Quarto. Pp. 60. Price $1.

This book contains a great deal of useful information for the architect as well as for the painter and decorator, giving the result of the labors of the committee appointed by the National Association to formulate a system of measurements of painter's work, which should be thoroughly accurate in every particular. There are six lithographic plates, measuring 16× 0 inches, showing the application of the system to houses of various designs and different interior and exterior details. It is only necessary to measure the work in accordance to the rules laid down, and apply the local price per square yard of plain surface, which is governed by cost of material and labor, to be able to correctly estimate the most complicated job of painting.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

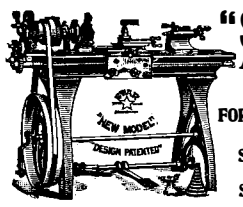
JUNE 19, 1900.

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Air brake for railway cars, H. W. Libbey ... 652,233
Air compressors, construction of double-acting, E. M. L. Duval ... 651,837
Air drying apparatus, J. Gayley ... 652,178
Air drying process, J. Gayley ... 652,179
Air, liquefier for atmospheric, C. E. Tripler ... 652,058
Anchor, folding, G. W. Blackburn ... 652,162
Annunciator, Beach & Doughty ... 652,015
Annunciator system, hotel, C. B. Clark ... 652,084
Armor plates, hardening and toughening, E. Ehrensberger ... 651,965
Automobile, J. C. Rantz ... 652,006
Axle brass, car, E. Jacquemin ... 652,026
Back pedaling brake, N. Mitchell ... 652,131
Bag. See Water tight bag.
Bag fastener, L. S. Short ... 651,937
Baling press, T. J. Corning ... 651,830
Baling press, T. D. James ... 652,115
Barge, fueling, S. B. Peck ... 651,931
Barrel, A. A. Porter ... 652,140
Bearing, ball, J. H. Little ... 651,870
Bed, J. K. P. Beard ... 652,158
Bed, sofa, W. T. Rolph (reissue) ... 11,831
Belt, electric, M. A. McLaughlin ... 652,217
Belt, electric, W. C. Sedwick ... 651,978
Bicycle, A. J. Harlan ... 651,993
Bicycle, C. von der Heide ... 651,907
Bicycle, chainless wheel, P. J. Freize ... 651,967
Biscuit machine, A. Pouey ... 651,885
Blotting pad, A. D. Glueck ... 651,844
Board. See Press board. Washboard.
Boiler setting, J. C. Black ... 652,015
Book, separate leaf, L. M. Morden ... 651,950
Boots or shoes, antislipping device for, D. A. McDonald ... 652,036
Bottle washer, A. P. Petterson ... 652,040
Box. See Mail box. Molding box. Oil box.
Box covering machine, J. F. Kachline ... 652,000
Brake. See Air brake. Back pedaling brake.
Brake lever, S. W. Hyatt ... 651,997
Brake releasing device, drive wheel, W. O. Pelham ... 652,218
Bridge, draw, J. Edwards ... 652,020
Bridge, rocking bascule, F. G. Vent ... 652,201
Bridge, swivel draw, J. Edwards ... 652,019
Broom holder, C. W. Brown ... 651,821
Brush, whitewash, W. McMahon ... 651,975
Brushes, manufacture of, C. E. Flemming ... 651,841
Buckets, detachable tooth for steam shovel, B. Brown ... 651,944
Buckle, E. Reyhing ... 652,043
Buggy top dust hood, Daugherty & Knoderer ... 652,090
Building construction, J. C. Pelton ... 652,219
Burner. See Gas burner. Liquid fuel burner. Vapor burner.
Button fastener, M. E. Krudemann ... 652,122
Calcimine compound, W. A. Hall ... 651,851
Calcium carbid, furnace for producing, Zimmerman & Prenner ... 651,916
Calendar, perpetual, E. G. Tasso ... 651,940
Can. See Oil storage can.
Car brake appliance, D. Taggart ... 652,055
Car draft rigging, C. F. Street ... 651,898
Car, dumping, S. Stewart ... 652,198
Car, railway, R. Harding ... 651,968
Car, railway, F. J. Sprague ... 652,049
Car replacer, E. Best ... 652,205
Carpet stretcher, F. B. Johnson ... 651,924
Caster, W. J. Martin ... 652,128
Caster, furniture, W. J. Martin ... 652,127
Chain links, machine for automatically bending, H. Spuhl ... 652,147
Chain links, welding swage for, H. Spuhl ... 652,146
Chair. See revolving chair.
Chart blank, W. H. Goodwin ... 652,023
Checkrein, W. Berry ... 652,151
Chuck, magnetic, O. S. Walker ... 651,908
Cigarette making machine, F. J. Ludington ... 652,151
Clamp. See Tube clamp.
Cleaner. See Cotton cleaner. Street cleaner.
Clinometer, F. T. Cable ... 652,078
Clip. See Toe clip.
Clip, W. Whiteley ... 651,910
Clock, phonographic, E. Treitschke ... 652,152
Clock, program, W. H. Hall ... 651,850
Cloth folder, A. Sinzheimer ... 652,048
Clothes holder, W. A. E. Henrici ... 652,025
Clothes line hook, E. H. Wilson ... 651,912
Clutch, friction, J. T. Ford ... 651,842
Clutch, friction, A. McNair ... 652,135
Clutch, friction driving, M. Backstrom ... 651,816
Coat, apparel, M. L. Kelley ... 652,117
Coin controlled lock, E. M. Harrison ... 651,854
Cooker or grill, T. H. Dibble ... 652,170
Cork polishing machine, Campbell & Dodge ... 652,165
Corset closure, apparel, Sheardown & de Palkowska ... 651,955
Cotton cleaner and feeder, J. W. Seifert ... 651,979
Cotton separator, distributer, and feeder, E. E. Bateman ... 651,986
Counting device, G. Schneider ... 651,892
Coupling. See Shaft coupling.
Crate, spring egg, J. P. Riley ... 651,887
Crushing mill, Hadfield & Jack ... 652,208
Culinary vessel, J. H. Rose ... 651,977
Cultivator, J. Youngblood ... 651,915
Currycomb substitute and massage block, A. S. Littlejohn ... 652,189
Curtain fixture, C. C. Thompson ... 651,984
Cutter, C. Muller ... 652,133
Cycle saddle, F. Rosenberg ... 651,933
Cycle seat tube, Hinrichs & Kruger ... 652,183
Defibrating machine, M. A. Torre ... 652,057
Dental heater, W. F. Slack ... 652,197
Dental instrument, W. E. Harper ... 651,922
Derrick apparatus, S. Mattson ... 651,972
Desk, register, J. W. & W. L. E. Appleyard ... 651,815
Dial, geographical, C. E. Davis ... 651,832
Dial, sun, E. G. Hewitt ... 652,109
Diaphragm motor, G. W. Lewis ... 652,032
Diffusion cell, C. Pfeiffer ... 651,883
Disintegrator, R. Hathaway ... 652,106
Door, grain, J. C. Munro et al ... 651,974
Door securer, R. W. Schutz ... 652,046
Dovetailing machine, J. E. Erickson ... 651,946
Draft equalizer, H. J. Freark ... 651,991
Drill. See Hand drill.
Dust and scrubbing pan, combined, F. C. Lillis ... 652,125
Dust, condensing flue, R. Ruetschi ... 652,045
Ear drum, artificial, L. H. Vickers ... 652,202
Egg case filler, E. R. Lionberger ... 652,126
Electric motor, C. L. Bundy ... 651,945
Electric motor, H. O. White ... 651,909
Electric motors and apparatus therefore, controlling, H. Leitner ... 652,124
Electric switch, automatic, P. S. Tirrill ... 652,151
Electrical distribution system, S. Krohn ... 652,187
Electrical waves and apparatus therefor, reducing attenuation of, M. I. Pupin ... 652,230
Electrical waves, reducing attenuation of, M. I. Pupin ... 652,231
Electrodes for storage batteries, machine for making, Hanscom & Hough ... 651,853
Electrolytic apparatus, M. Haas ... 651,849
Elevator. See Water elevator.
Elevator safety attachment, C. Kimball ... 652,118
Engine. See Explosive engine. Rotary engine. Rotary steam engine.
Engine starting and reversing device, combustion, E. S. Haines ... 652,104
Exhibitor, card, J. A. Mangold ... 652,192
Explosion engine, G. A. Fleury ... 651,966
Extractor. See Nail extractor.
Eyeglasses, L. A. Dupaul ... 651,989
Fastener, J. D. Sirckler ... 651,983
Faucet, beer, H. S. Johnson ... 651,999
Feeder, boiler, R. McDougall ... 652,134
Felly shield for vehicle wheels, J. R. Singer ... 651,981
Fence, C. Stierlin ... 652,050
Fifth wheel, J. H. Little ... 651,871
Filter, R. P. Lawson ... 651,948
Filter valve, C. E. Torrance ... 651,901
Filtering apparatus, water, C. L. Deutsch ... 651,833
Firearms, cleaning rod for, F. K. Dunn ... 652,096
Fire escape, portable, J. A. Hoyt ... 651,995
Fire extinguisher, D. W. Diggs ... 651,836
Fire extinguishing sprinkler systems, pneumatic hydraulic alarm for, Hill & Richardson ... 651,857
Fireman's helmet, J. R. Chappell ... 652,080
Fireproof structure, J. Streifler ... 652,051
Flagstaff holder, W. I. Sherwood ... 651,980
Flask and heater, combined, A. Pearlstine ... 651,952
Frame. See Mattress frame.
Fur unhairing machine, Hedbavny & Rothe ... 652,182
Furnace. See Ore roasting furnace. Smelting furnace. Smokeless coal burning furnace.
Furnace, L. T. Buck ... 652,163
Furnace, Hughes & Bishop ... 652,110
Fuse igniter, M. O. Smith ... 651,939
Gage. See Marking gage.
Game, parlor, H. J. Tait ... 652,056
Garment hanger, O. C. Kavle ... 651,970
Garment pad, G. Goldman ... 652,102
Gas burner, H. F. Gabel ... 652,167
Gas burner, acetylene, K. H. Raupp ... 652,141
Gas generator, acetylene, O. D. Fry ... 652,098
Gas generator, acetylene, J. H. Green ... 651,848
Gas generator, acetylene, J. S. Harger ... 652,200
Gas generator, acetylene, C. M. Lindholm ... 651,869
Gas generator, acetylene, A. McKenzie ... 651,881, 651,882
Gas generator, water, J. W. Chrisholm ... 652,082
Gas igniting device, A. Martini ... 651,875
Gas injecting apparatus, E. Sterne ... 652,149
Gas, manufacturing, J. W. Chisholm ... 652,081
Gas or other burners, mixer for, C. W. Claybourne ... 652,085
Gas purifier, G. P. Washburn ... 651,959
Gases, etc., and manufacturing same, receptacle for, H. Platz ... 651,884
Gate, J. C. Duner ... 652,018
Gate, A. Willi ... 651,911
Generator. See Gas generator.
Glass, producing attachment surfaces upon, A. J. Davis ... 652,091
Golf club, H. C. Cushing, Jr ... 651,920
Governor for fluid pressure engines, F. M. Rites ... 651,953
Gramophone motor, L. P. Valiquet ... 651,904
Grinding machine, E. Rivett ... 652,007
Gun carriage or other vehicle, J. A. Wilding ... 652,154
Hand drill, J. E. Olsen ... 652,137
Hanger. See Garment hanger.
Hat packing ring machine, L. T. Hallock ... 651,992
Hat rack and advertising device, combined, W. M. Hurlburt ... 661,858
Heater. See Dental heater. Tank heater. Water heater.
Hinge, H. Meyer ... 651,876
Hinge, lock, O. A. Kell ... 652,001
Hog trap, H. L. Ground et al ... 652,103
Hoist, E. B. Achee ... 652,069
Hook. See Clothes line hook.
Hook and eye, E. C. Beecher ... 652,160
Hoop. See Metal hoop.
Hotel registers, advertising desk for, H. Hatch ... 652,225
Hub and spindle, vehicle, J. P. Byne ... 651,823
Ice, manufacturing, E. R. Butler ... 651,963
Ink supply for ink bottles, automatic, I. L. Davenport ... 651,831
Inking apparatus, H. H. Jacobus ... 652,113
Iron rest, S. O. Hubbard ... 651,996
Jack. See Lifting jack. Lumber jack.
Jack, C. W. Doane ... 652,094
Joint. See Railway rail joint.
Knitting machine, H. A. Klemm ... 652,186
Ladder and roof bracket and window jack, combined, G. K. Wheeler ... 652,010
Lamp, acetylene gas generating, A. C. Einstein ... 652,173
Lamp, binnacle, G. A. Baker ... 652,012
Lamp, carbureting, A. L. Taber ... 652,054
Lamp, electric arc, A. B. Walton ... 651,985
Lamp, electrical incandescent, von Recklinghausen & Vogt ... 652,194
Lamp, incandescent, I. Kitsee ... 651,866
Lamp, spirit incandescent, K. Lehmann ... 651,925
Land roller, J. Gilbert ... 652,100
Last, E. C. Wright ... 652,011
Lathes, combination back knife for turning, Miller & Knapp ... 652,130
Leather stretching machine, J. Brooks ... 651,820
Ledger, loose leaf, H. Swalley ... 651,899
Lifting jack, F. I. Joyce ... 651,860
Liquid fuel burner, P. E. Thurow ... 651,900
Lock. See Coin controlled lock.
Lock, C. E. Johnson ... 651,947
Locomotive sanding device, J. C. Hooper ... 655,212
Locomotive whistle signal for railway crossings, automatic, H. B. Smith ... 652,145
Loom, H. I. Harriman ... 652,105, 652,224
Loom, E. S. Stimpson ... 652,222

(Continued on page 412.)



"Star" Foot and Power Screw Cutting Automatic Cross Feed **Lathes**

FOR FINE, ACCURATE WORK

Send for Catalogue B.

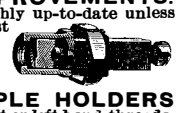
SENECA FALLS MFG. CO.
695 Water Street,
Seneca Falls, N.Y., U. S. A.

ENGINE & FOOT LATHES. MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. CATALOGUE FREE. SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

HAVE THE LATEST IMPROVEMENTS.

No machine shop can be thoroughly up-to-date unless it has the most modern perfected tools. For instance, the

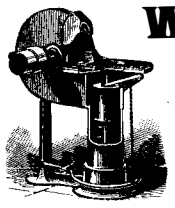




ASHLEY PATENT NIPPLE HOLDERS

hold nipples for cutting *either right or left hand* threads. They hold the sleeve from turning and take the strain off both the sleeve and shank thread. Made of best quality cast steel, carefully fitted. Long or short nipples cut with equal facility. The Ashley Holders are of light weight and compact form.

WALWORTH MANUFACTURING CO.
128 TO 136 FEDERAL ST., BOSTON, MASS.



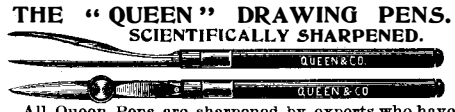
Water Emery Tool Grinder

Has no pumps, no valves. No piping required to supply it with water. Always ready for use. Simplest in construction, most efficient in operation.

☞ *Send for catalogue and prices.*

W. F. & JNO. BARNES CO.
1999 Ruby St., Rockford, Ill.

THE "QUEEN" DRAWING PENS.
SCIENTIFICALLY SHARPENED.



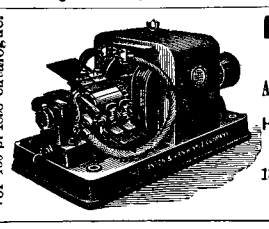
All Queen Pens are sharpened by experts who have had many years' experience in making and sharpening Drawing Pens. Only the finest English Steel is used in the Queen Pens, and they are hand-made and carefully tempered by our improved process. **QUEEN & CO., Inc.,** Mathematical, Engineering and Scientific Instrument Makers, **1010 Chestnut St., Philadelphia.**

PERFORATED METAL OF EVERY DESCRIPTION AND FOR ALL USES
THE HARRINGTON & KING PERFORATING CO.
225 N. UNION ST. CHICAGO, ILL. U.S.A.

Why Not Make Rubber Stamps?

Our "New York" Rubber Stamp Vulcanizers received the only medal awarded any Vulcanizer, World's Fair, Chicago. Simple process. Large profits. *Circulars free.* **Barton Mfg. Co., Dept. A, 338 B'way, New York, U. S. A.**

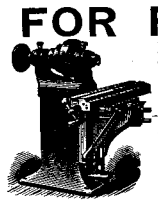
Send your business card for 160 p. 1898 catalogue.



NICKEL AND **Electro-Plating** Apparatus and Material.

THE Hanson & VanWinkle Co.,
Newark, N. J.
136 Liberty St., N. Y.
30 & 32 S. Canal St Chicago.

FOR FINE WORK



No machine on the market can equal our **No. 00 Hand Bench Milling Machine** with two speed counter. Spindles and bearings of hardened and ground tool steel. Arranged to take same size chucks and other attachments as fit mouth of bench lathe spindle. Traverse movement of table 7 inches. Fuller description in free illustrated booklet.

The Pratt & Whitney Co., Hartford, Conn.

WORKS LIKE A CHARM.

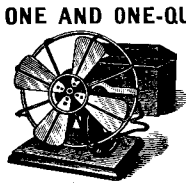
Perfect satisfaction is experienced using our No. 5, 6 or 9 **Hand Pipe Threading and Cutting Machines.** Crank or ratchet power. Gears housed from dust. Chasers set by graduation to any size, can be released from threading while in motion, opened to permit pipe being cut, and instantly closed.



☞ *Send for Free Catalogue to*

The Merrell Manufacturing Co., 501 Curtiss Street, Toledo, Ohio.

ONE AND ONE-QUARTER CENTS PER HOUR



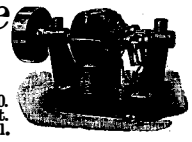
it costs to keep cool if you buy one of our $15.00 Battery Fan outfits consisting of 1 Battery Motor No. 2, 1 8-inch Fan, 1 Fan Guard, 3 Cells Battery, 1 Charge for Battery, 5 ft. Double Conductor Cord, 1 Cabinet 19¼x6¾x8¾. Will run 100 hours with one charge.

OUR $5.00 OUTFIT will keep you cool.

J. JONES' SON & CO., 64 Cortlandt St., New York.

Manufacturers of all kinds of electrical supplies.

Gas Engine IGNITER



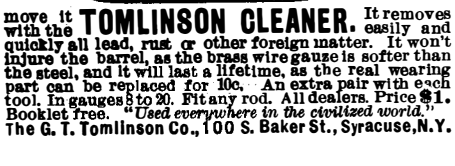
Complete with spark coil, $12.00. The **Best Thing** on the market. Latest and most improved model.

☞ *Send for Circular.*

The Carlisle & Finch Co., Sixth Street, Cincinnati, O.

IF YOU HAVE A SHOTGUN

and use it often, you know the barrel "leads"—the friction leaves a lead depost which causes "pits" and means expense. You can't stop the deposit, but you can remove it with the **TOMLINSON CLEANER.** It removes easily and quickly all lead, rust or other foreign matter. It won't injure the barrel, as the brass wire gauze is softer than the steel, and it will last a lifetime, as the real wearing part can be replaced for 10c. An extra pair with each tool. In gauges 8 to 20. Fit any rod. All dealers. Price **$1.** Booklet free. *"Used everywhere in the civilized world."*



The G. T. Tomlinson Co., 100 S. Baker St., Syracuse, N.Y.

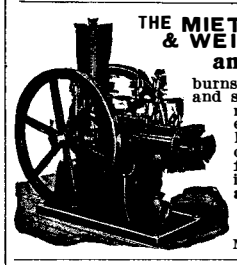
Loom box motion, T. G. Moser	651,973
Loom harness, P. A. Wagner	652,000
Loom seat, J. B. Bolton	651,917
Loom tuft weaving and cutting device, O. Hallensleben	651,852
Loom warp stop motion, electrical, H. I. Harriman	652,223
Looms for weaving haircloth, stop motion for, J. W. Clark	652,206
Lubricating apparatus, H. Dangler	652,089
Lumber jack, F. W. Reitz	652,221
Mail box, G. Trevett	651,958
Marking gage, J. Opland	652,038
Mattress frame, J. A. Hutchison	652,213
Measuring consumption of electric currents, apparatus for, C. R. Loubery	652,214
Measuring device for rolled goods, Sauls & Cook	651,891
Mechanical movement, A. W. Copland	651,823
Metal hoop, J. E. Wright	651,914
Metal wheel, E. Einfeldt	652,097
Metallic leaf, device for laying, F. W. Koenig	652,121
Mill. See Crushing mill.	
Miter cutting machine, J. W. Oliver	652,136
Molding box or flask, O. S. Michaelsen	652,129
Motor. See Diaphragm motor. Electric motor. Gramophone motor. Rotary motor.	
Motor, J. B. Kelly	651,862
Mower, lawn, R. K. Ortt	652,138
Mower, lawn, S. P. Townsend	651,902
Mucilage tube, collapsible, W. Rodiger	651,932
Muff, face, B. F. Shibe	652,196
Musical instrument, A. Jaccard-Rod	651,998
Nail extractor, C. O. Diener	652,093
Nail extractor, D. A. Kincaid	652,002
Necktie, H. Goldberg	651,846
Needle threader, A. M. Felson	652,175
Nest, poultry, J. W. Hays	652,211
Nipple holder, C. W. Meinecke	652,034
Nozzle, V. C. Swanson	652,053
Nozzle for depositing machines, A. W. Copland	651,829
Numbering machine, Monahan & Gooding	652,215
Oil box, D. Long	651,872
Oil storage can or device, W. E. Forest	651,990
Ore roasting furnace, H. B. Meech	652,193
Ore, treatment of, G. de Bechi	652,072
Oven, baking or cooking, J. E. Rebstock	651,886
Packing rings, apparatus for securing piston, R. E. Strait	651,956
Pad. See Blotting pad. Garment pad.	
Pan. See Dust and scrubbing pan.	
Paper barrel, J. Van Develde	651,906
Paper box blanks, shaping, H. B. Smith	651,962
Paper registering mechanism, T. C. Dexter	652,169
Paring machine, fruit, H. M. Haff	652,181
Pegging machine, A. G. Leonard et al	652,031
Phonograph, E. C. Geneux	651,843
Photographic negative washing device, J. L. Jenks	651,923
Photographic vignetter, C. W. Christman	652,083
Photographing apparatus, gas, A. G. Adamson, 652,156,	652,204
Piston, J. B. Kelly	651,864
Pitman for mowers or the like, C. G. Abrahamson	652,068
Planter, corn, E. W. Bowers	651,918
Planter, corn, J. E. Lucas	652,190
Plastering columns or the like, apparatus for, J. R. Tobin	651,957
Plate holder, magazine, H. J. Erkenswick	652,174
Plowshare, C. C. Coffinberry	652,086
Plowshare, reversible self sharpening, J. R. Trull	652,153
Pocket holder, E. J. Haverly	652,108
Polishing machine, A. D. Erb	651,839
Powder distributer, H. MacMichael	651,926
Press. See Baling press. Printing press.	
Press board, F. O. Rundquist	651,889
Printers' leads, machine for casting, C. P. Babcock	651,961
Printing machine, H. H. Jacobus	652,111
Printing press, multicolor, G. Kempf	651,971
Printing roller, H. H. Jacobus	652,112
Projectiles, securing caps to, O. Hartmann	651,969
Propeller, screw, P. G. Lavigne	652,123
Pulley, variable diameter, Desprez & Duthuit	652,092
Pump, deep well, S. M. & J. Polson	652,041
Pyrites, etc., apparatus for cleaning or washing, Bunnett & Newbigin	651,822
Pyrobetulin, obtaining, J. Wheeler	651,942
Rack. See Hat rack.	
Railway appliance, L. T. Sheffield	651,893
Railway, electric, W. Kingsland	652,005
Railway rail, H. W. Libbey	652,234
Railway rail joint, J. W. Stevens	651,895
Railway rail, street, D. J. Clark	651,825
Railway switch, D. MacPherson	652,033
Railway ties, tamping instrument for, F. Sheppard	652,195
Recorder. See Speed recorder. Time recorder.	
Refrigerating apparatus, W. W. Harris	652,210
Refrigeration, automatic system of, C. J. Coleman	651,826
Refrigeration, electrolytic system of, C. J. Coleman	651,827
Registering apparatus, W. A. A. Roper	651,888
Respiratory diseases, apparatus for treating, D. Bogbean	651,962
Revolving chair or stool, J. Ellenbecker	652,021
Rheostat, T. F. Jordan	652,116
Roller. See Land roller. Printing roller.	
Rolling mill guide, O. F. Leibert	651,868
Roofing, F. W. Terpening	652,150
Roofing compound, K. Wessel	652,065
Rotary engine, D. M. Dearing	652,168
Rotary engine, J. Eastburgh	651,838
Rotary engine, G. C. Rohde	652,044
Rotary motor, M. Michon	652,035
Rotary steam engine, J. B. Kelly	651,861
Sash construction, W. W. Holland	651,994
Sashes, shutters, etc., device for counterbalancing, G. Barnes	652,071
Satchel, M. S. Ersler	652,022
Saw filing or setting machine adjuster, A. C. Saxton	651,934
Sawmill carriages, feed controlling mechanism for, J. A. Waterman	652,062
Saw, steam power cross cut, J. B. Kelly	651,865
Scale, recording car, G. Goetz	651,845
Scissors, buttonhole, L. Chybczynski	652,166
Scooping, hoisting, and conveying apparatus, F. H. Kindl	652,185
Scraper, cotton, J. M. Sugg	652,199
Screw holder and driver, T. R. Lillie	651,949
Sealed metallic boxes or tins, cutter for opening, Williamson & Culpin	652,067
Seat. See Loom seat.	
Seeders, wind break for grain, E. R. Butts	651,988
Separating and bolting machine, A. C. Brantingham	651,987
Separator. See Cotton separator. Steam separator.	
Separator system, D. Cockrell	651,919
Serum, preparing remedial, F. Niemann	651,951
Sewing machine, button, E. M. Phelps	652,220
Sewing machine feeding mechanism, P. Diehl	652,172
Sewing machine feeding mechanism, F. W. Ostrom	651,930
Sewing machine hemmer attachment, J. A. Cameron	652,079
Sewing machine welt guide, A. Bergstrom	652,014
Sewing machines, oscillating shuttle mechanism for, P. Diehl	652,171
Shaft coupling, right angle, S. W. Robinson	652,142
Shirt bosom, apparel, S. Butz	652,164
Shoe fastener, S. Goodman	651,847
Shoe fastening, J. F. Pope	651,976
Sign, N. Goldberg	652,101
Signal rods, antifriction guide for, H. Johnson	652,028
Signals, indicating key for selective, Scribner & McBerty	651,936
Smelting furnace, high temperature, W. Borchers	652,076
Smoke consumer and steam generator, Bishop & Hughes	652,074
Smokeless coal burning furnace, A. Heberer	652,227
Soap cake, L. S. Samuel	651,954
Soles, etc., machine for cutting boot or shoe, Beauregard & Gooding	652,159
Span wire pole and system, J. Lanz	652,188
Speed recorder, A. T. Hill	651,856
Spinning mule, J. D. Whyte	652,203
Sprayer, D. B. Smith	651,938
Stacker, attached swinging straw, M. F. Stadtmuller	652,148
Stamp, M. R. Driscoll	652,095
Steam separator, W. J. Baker	652,070
Steel, manufacture of open hearth, A. Monell	652,226
Steering gear for ships, Suppan & Szendi	652,052
Stove, W. H. James	651,859
Stove, gas, W. J. Ranck	652,042
Street cleaner, McCrory & Hinkson	651,880
Sulfuric anhydrid, making, J. Knietsch	652,119
Switch. See Electric switch. Railway switch.	
Switches, frogs, etc., spring box for, W. B. Cooke	652,088
Tacking tool, hand, T. Cowburn	652,167
Talking machines, intermittent feed for, L. P. Valiquet	651,905
Tank heater, H. C. Barden	652,157
Tanning hides, A. H. Schmidt	651,935
Telegraphic signals, reception and translation or retransmission of, A. Muirhead	652,229
Telephone toll apparatus, J. T. Belanger	651,817
Thermometer, oven, G. J. Day	652,017
Thresher, pea or bean, W. H. Greer	652,180
Threshing machine, J. Fahrney	651,840

(Continued on page 415)

The Brunswick

Always the same. We maintain the quality no matter what the market price of tobacco. Try them once. You will buy them always. *Look for Arrow Head on every Cigar.*

JACOB STAHL, JR. & CO., Makers, 168th St. & 3rd Ave., N. Y. City.



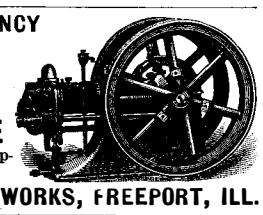
THE MIETZ & WEISS **KEROSENE and GAS Engine**

burns **KEROSENE** cheaper and safer than gasoline. Automatic, simple, reliable **No** electric battery or flame used Perfect regulation. Belted or directly coupled to dynamo for electric lighting, charging storage batteries **and all power purposes.**

☞ Send for Catalogue.

A. MIETZ,
128-138 Mott St., New York.
Markt & Co., London, Hamburg, Paris

HIGHEST EFFICIENCY attained in the **STOVER GASOLINE ENGINE**



The best is always cheapest. *Write for prices.*

STOVER ENGINE WORKS, FREEPORT, ILL.

BUILD YOUR OWN ENGINE.



WITH OUR **CASTINGS**
GASOLINE ENGINES & LAUNCHES COMPLETE READY FOR USE.
CATALOGUE FOR 4 STAMPS
GERE LAUNCH AND ENGINE WKS. GRAND RAPIDS, MICHIGAN, U.S.A.

MARINE & STATIONERY ENGINES



$200 & OVER
SEND 3¢ FOR CATALOGUE TO
GRAND RAPIDS (MICH.)
BRANCH 12 EXCHANGE PLACE, NEW ORLEANS, LA.
GAS-ENGINE & YACHT Co.
3¼ TO 45 HORSE POWER
1-2-3-CYLINDER

A. W. FABER

Manufactory Established 1761.

LEAD PENCILS, COLORED PENCILS, SLATE PENCILS, WRITING SLATES, STEEL PENS, GOLD PENS, INKS, PENCIL CASES IN SILVER AND IN GOLD, STATIONERS' RUBBER GOODS, RULERS, COLORS AND ARTISTS' MATERIALS.

78 Reade Street, - - - New York, N. Y.

Manufactory Established 1761.

WILLIAMS' SHAVING STICK

THE ACME OF LUXURY



THE PINNACLE OF PERFECTION

SOLD EVERYWHERE — BY MAIL 25c.
IF YOUR DEALER DOES NOT SUPPLY YOU.

THE J. B. WILLIAMS CO.
GLASTONBURY CONN.
LONDON - PARIS - DRESDEN - SYDNEY.

Magneto for Gas or Gasoline Engine Igniters

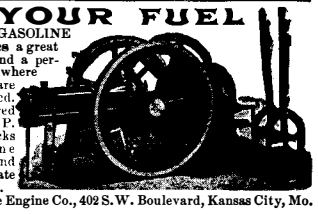


No batteries used. Self-lubricating bearings. Dust and moisture proof. Brushes self-adjusting. Material and workmanship the BEST. ☞ GUARANTEED FOR ONE YEAR. Send for circular and price list.

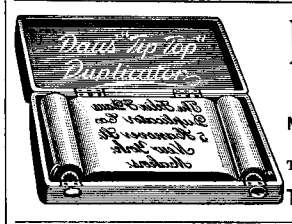
GIDDINGS & STEVENS, Rockford, Ill.

SAVE YOUR FUEL

You will find our GASOLINE **Hoisting Engines** a great saving over steam and a perfect economical boon where wood, coal or water are scarce and high priced. Both friction and geared hoist from 6 to 150 H. P. for mines, quarries, docks etc. Every machine fully guaranteed. Send for free catalog and state size of engine wanted.



Weber Gas & Gasoline Engine Co., 402 S. W. Boulevard, Kansas City, Mo.



Daus' "Tip-Top" Duplicator

100 SHARP AND DISTINCT COPIES IN BLACK FROM PEN AND 50 COPIES FROM TYPEWRITER

NO WASHING, NO PRINTERS' INK, NO STENCIL. Price, Complete, $5.00.

SENT ON TEN DAYS' TRIAL TO RESPONSIBLE PARTIES

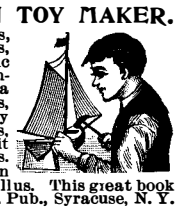
The "TIP-TOP" reproduces the handwriting so exceedingly faithful that copies duplicated in Black Ink on this apparatus are often taken for ordinary written letters and not duplicates.

The Felix F. Daus Duplicator Co. (Inc.), 1 to 5 Hanover St., New York

MERITORIOUS INVENTIONS

financed or patents sold outright. Capital furnished for good enterprises at 5 per cent. Stock companies formed and influential directors procured. Stocks and bonds sold. We transact all business on commission strictly. No advance fees. PETER WHITNEY, 100 Broadway, New York.

EVERY BOY HIS OWN TOY MAKER.



Tells how to make all kinds Toys, Steam Engines, Photo Cameras, Windmills, Microscopes, Electric Telegraphs, Telephones, Magic Lanterns, Æolian Harps, Boats from a rowboat to a schooner; also Kites, Balloons, Masks, Wagons, Toy Houses, Bow and Arrow, Pop Guns, Slings, Stilts, Fishing Tackle, Rabbit and Bird Traps, and many others. All is made so plain that a boy can easily make them. 200 handsome illus. This great book by mail, 10c., 3 for 25c. C. DEPUY, Pub., Syracuse, N. Y.

IMPORTED ALL JVS LAVA **Acetylene Gas Burners.**



Schwarz Perfection Lava Burner.

Highest awards in all Acetylene Expositions. Made of one piece of *lava.* Are faultless and *every one tested and guaranteed.* ☞ *Send for Price List.*

NO Blowing. Smoking. Carbonization. Perfect Alignment.

Sole Agents for the U. S. and Canada.

M. KIRCHBERGER & CO.
50 Warren Street, New York.

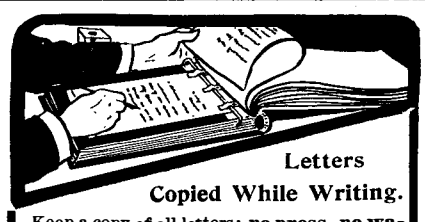
THE Batchelors WIFE? HOLDS LIKE A VISE PURE ALUMINUM

A New Button

THE BEST THING YET!

Is simple and durable, and can be put on and taken off at will. Nothing like it in the world. Try a set and be convinced. If your dealer does not keep them send 25c. to us for sample doz.

THE L. & H. SUPPLY CO., 85 Commercial Avenue, Binghamton, N. Y.



Letters **Copied While Writing.**

Keep a copy of all letters; **no press, no water, no brush, no work. Any ink, any pen, any paper.** Our Pen-Carbon never smuts. Our clip holds paper firm. Write with no extra pressure, and our **Pen-Carbon Letter Book** produces a *perfect* copy. Can be used anywhere.

If your stationer does not keep it, write for *free* specimen of work. *Mention this paper.*

PEN-CARBON MANIFOLD CO.,
Dept. 1, **145-7-9 Centre St., New York.**

The President Suspender

Improved



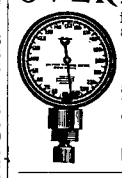
The only suspender in the world that absolutely conforms to every bend of the body. The only guaranteed suspender that combines perfect ease, convenience and style—and metal parts will not rust

$1,500 For Your Estimate

A novel competition on the Presidential vote open to all wearers of President Suspenders. Get information from dealer. Handsome booklet sent free. President Suspenders sold everywhere, 50 cents, or direct from us.

C. A. EDGARTON MFG. CO., Box 222 Shirley, Mass.

OVERHEATED BOILERS



in factories, workshops, and on steamships are apt to suddenly burst unless carefully regulated and watched. Our

HOT WATER THERMOMETERS

are used to indicate danger in time to prevent it. They are in use in all the new ships of U.S. Navy and also in the Japanese Navy.

Illustrated Bulletin No. 40 sent free.

HELIOS-UPTON CO., PEABODY, MASS.

Agents Wanted



The Standard.

The only "Dripless" Tea and Coffee Strainer. No drip to soil linen. No falling off. Nickel plated. Mailed on receipt of 25 cents.

Standard Strainer Co. Dept. K, 37 Maiden Lane, New York.

Did You Ever Know

that **"GLACIER"** is a perfect **SUBSTITUTE FOR STAINED GLASS?** The cost is very little, and it is easy to apply to any window. Send us dimensions and we will be pleased to submit an estimate and samples. **G. QUAILE, 396 Broadway, New York.** Sole Agent for United States and Canada.

MENTAL NUTS. **Can You Crack 'Em?** A book of 100 rare catch problems. Real brain ticklers. Mailed for 10c. stamps. HOME SUPPLY CO., 132 Z Nassau Street, NEW YORK.

ROAD BUILDING MACHINERY AND SUPPLIES OF EVERY DESCRIPTION
ACME ROAD MACH'Y CO.— FRANKFORT N.Y. U.S.A.

INDEX.

ILLUSTRATIONS.

A

Academy building, West Point.. 385
Acetylene, explosive.. 8
Acetylene generator.. 84
Acetylene in raising vessels.. 261
Acetylene lamp, Baldwin.. 394
Aeronautics, practical.. 116
Africa, South, natives of.. 56
Air compression, hydraulic...258, 263
Air, liquid, experiments.. 201
Air pump, electric.. 324
Airship, Danilewsky.. 43
Airship, Von Zeppelin's.. 325
Albany, cruiser.. 152
Alexandre III. bridge.. 145, 149
Amalfi, landslide at.. 6
Ambulance, automobile.. 148
Anchor for rails.. 149
Amgoon, paddle steamer.. 200
Armorclad Marshal Deodoro.. 184
Armor manufacture.. 353, 358
Armor plate for coffins.. 314
Asbestos mines of Canada.. 213
Assay of gold and silver ores.. 341
Automobile ambulance.. 148
Automobile forecarriage.. 89
Automobile, military.. 408
Automobile omnibus.. 245
Automobile patrol wagon.. 148
Automobile show.. 89
Automotor trolley.. 219
Auto-quadricycle.. 104

B

Balloon air-ship, Danilewsky.. 43
Balloon, captive.. 117
Banyan tree, remarkable.. 91
Barges, steel.. 200
Basuto woman.. 56
Bathing, sea coast.. 385
Battery, storage, new.. 261
Battle monument.. 385
Battleship Georgia.. 361
Battleship Petropavlovsk.. 308
Battleship Shikishima.. 264
Battleship Suffern.. 184
Bayonet plant, Spanish.. 209
Bear, grizzly, cubs of.. 10
Beetle, storeroom.. 347
Benzine motor, airship.. 325
Bethlehem Steel Works.. 353, 358
Bicycle, cushion-frame.. 37
Bicycle, development of.. 88
Bicycle motor equipment.. 132
Billiard ball, mishap to.. 58
Birds, sea, value of.. 267
Blackwall tunnel.. 209, 217
Blast, remarkable.. 208
Boat, a revolving.. 213
Bookworm, the.. 347
Borax, Californian.. 321, 326
Bottle, non-refillable.. 212
Bowles, Francis T.. 137
Bridge, Alexandre III.. 145, 149
Bridge, East River.. 289, 294
Bridge, East River, cables.. 52
Bridge, lift roller.. 376
Bridge, memorial, Paris.. 313
Bridge, memorial, Potomac.. 313
Bridge traveling crane.. 81, 85
Bridge, Tugela.. 116
Bridges, Mississippi.. 168
Bud transplanter.. 122
Burner for incandes. mantles.. 212

C

Cable, submarine, first.. 388
Cables, East River bridge.. 52
Cabs, electric, of Paris.. 345
Cadet barracks.. 392
Camera for color photog.. 165
Camera, Kromskop.. 277
Camera, panoramic.. 282
Canal, drainage, Chicago.. 77
Canal locks, new.. 65, 74
Canal, power, Sault.. 328
Car fender, new.. 343
Car, shouldering.. 324
Carborundum, manufacture of.. 377
Carriage, motor, military.. 59
Carriage, motor, Winton.. 229
Carthage, excavations at.. 73
Casting pig iron.. 113, 118
Catalina aquarium diver.. 395
Cats, mummified.. 361
Cave dwelling, a.. 40
Chain wrench for pipes.. 37
Chamberlin, W. H.. 250
Channeling machines.. 328
Charging machine, electric.. 312
Chemical growth.. 155
Chicago drainage canal.. 97
Chief of Tetuila.. 139
Chimney, tall, felling a.. 372
Cliff dwellings.. 40
Clutch, magnetic.. 100
Coal-cutting machine, electric.. 389
Coffins, armor plate for.. 314
Coin-in-slot machine.. 378
Compass, a simple.. 260
Controlling works, Lockport.. 106
Corn hiller, new.. 132
Cotton-picker, improved.. 330
Cotton, round-bale.. 120, 121
Cotton trade schools.. 337, 342
Crane, traveling, for ore.. 81, 85
Cranes, cantilever.. 105
Croton dam.. 33, 36
Cruiser Albany.. 152
Cruisers, high-speed.. 405
Cullum Memorial Hall.. 385
Curtain hanger, new.. 310
Cycle, motor, Steffey.. 132

D

Dam at Austin, failure.. 265
Dam, Croton.. 33, 36
Death Valley.. 309
Deck, elevating, ferry.. 216
De Morgan, J.. 169
Derricks at asbestos mine.. 213
Detonator, waterproof.. 330
Diamond mines, Kimberley.. 56, 57
Dish washers, new.. 116
Dismal Swamp.. 249
Ditch digging machine.. 281
Diver, Catalina aquarium.. 395
Dock, floating, 700-foot.. 241, 248
Drainage canal, Chicago.. 97
Drawings, perspective.. 228
Drawings, working, printing.. 235
Draughtsman, mechanical.. 228
Driers, improved.. 396
Driving gear, new.. 165
Dump at Thetford.. 213
Dwelling, an attractive.. 363
Dwellings, cliff.. 40

E

Earthquake, San Jacinto.. 27
East River bridge.. 287, 294
Eclipse of sun.. 244, 360
Eclipse, solar.. 376
Electro-magnetic machine.. 68
Elevators, grain.. 232
Elevators, mine.. 244
Elk, destruction of.. 171
Engine, kerosene.. 21
Engine, rope armored.. 212
Engine, traction, for Siberia.. 276
Engine valve gear.. 276
Engines, pumping.. 185
Engines, steam, novel form.. 181
Engines, stopping device.. 84
Engines, traction, armored.. 388
Erie Canal locks, new.. 65, 74
Esplanade des Invalides.. 344
Excavations at Carthage.. 73
Exposition, Paris.. 344

F

Fender, car, new.. 343
Ferryboat, elevating deck.. 216
Fiber-cleaning machine.. 276
Filtration plant.. 177, 182
Fish, seal, bones of.. 107
Flagship, Farragut's.. 53
Flashing device.. 166
Fly screen.. 292
Flying machine, Danilewsky.. 43
Food, preparing, Samoan.. 139
Forecarriage, automobile.. 89
Forest preservation.. 393
Fuel feed, furnace.. 116
Furnace and stove combined.. 149
Furnace, electric, Stassano.. 68
Furnace, smoke consuming.. 196
Furnaces, fuel feed for.. 116
Fuse detonator.. 330

G

Gasoline gun carriage.. 59
Gear, driving, new.. 165
Gear, reversing.. 100
Gear, valve, engine.. 276
Georgia, battleship.. 361
Globe, celestial, Paris.. 367
God, Indo-Chinese.. 367
Gold deposits, Cape Nome.. 315
Gold ores, assay of.. 341
Gold saving machine.. 315
Grain elevators.. 232
Grain vessels, loading.. 232
Gun, automatic, Colt.. 229
Gun, ball-bearing.. 218
Gun carriage, gasoline.. 59
Gun cleaner, a.. 378
Guns and armor, manufacture.. 305
Guns, manufacture of.. 353, 358
Gymnasium, West Point.. 385

H

Half-tone work, test in.. 155
Hall, Memorial, Cullum.. 385
Hammer, foot-power.. 52
Hares, Belgian.. 134
Hartford, U. S. S.. 53
Headlights, electric.. 373
Hogan, a Navaho.. 233, 234
Hotel of Cappuccini.. 6
House moving by water.. 154
Houses, Navaho.. 233, 234

I

Ibis, the.. 72
Indian mummy.. 203
Infantry, shields for.. 340
Irishman or creeper, the.. 181
Iron, pig, casting.. 113, 118

K

Kafirs of South Africa.. 50
Kaiserin Maria Theresia.. 197
Kearsarge, turrets of.. 225, 230
Kerosene engine.. 21
Kimberley diamond mines.. 56, 57
Kromskop camera.. 277

L

Ladder, fire, self-launching.. 404
Lake Drummond.. 246
Lamp, acetylene, Baldwin.. 394
Lamprey, three-toothed.. 235
Landslide at Amalfi.. 6
Lantern slide, sound wave.. 84
Light, search, plant.. 72
Lightship, steam, electric.. 161, 166
Liquefier, Pictet.. 202
Liquids, apparatus to raise.. 122
Locks, new, Erie Canal.. 65, 74
Locomobile, the.. 49, 54
Locomotive, protected.. 212
Locomotives, compound.. 101
Loomis motor.. 89
Loops and nodes.. 84
Lubricator, automatic.. 22
Lumber hoisting pulley.. 374

M

Machinery guard.. 37
Mantles, incandescent.. 212
Maps, weather, making.. 38
Marine, merchant, American.. 273
Marshal Deodoro, armorclad.. 184
Mine elevators.. 244
Mines, asbestos, Canada.. 213
Mines, borate.. 321
Mines, diamond, Kimberley.. 56, 57
Mineola, yacht.. 373
Mirror, window.. 262
Monument, Battle.. 385
Mosaic, wood.. 341
Motor attachment, bicycle.. 132
Motor carriage, military.. 59
Motor carriage, Winton.. 229
Motor, hydraulic, Wall.. 363
Motor, Loomis.. 89
Motor, storage battery.. 340
Motor wheel, vehicle.. 11
Motors, airship.. 325
Motors, 7½ h. p.. 246
Mowing machine, early.. 75
Mule, a borax.. 321
Mummy, Indian.. 203
Mummies of cats.. 361
Museum, children's.. 296, 297

N

Navaho houses.. 233, 234
Navigation building, Paris.. 369
Navy Yard, New York.. 129, 137
Nodes and loops.. 84

O

Ocean liner, horse power of.. 193, 199
Office building, model.. 298
Oil engine, improved.. 21
Oil switch, pneumatic.. 26
Omnibus, automobile.. 245
Ore unloader.. 7
Orograph.. 293
Ostia, port of Rome.. 409

P

Pango Pango, wharf.. 134
Paris Exposition, perspectives.. 401
Park, water, Boynton's.. 117
Park, Zoological, New York.. 3, 10
Patrol wagon, automobile.. 148
Petropavlovsk, battleship.. 308
Photography, aerial.. 314
Photography, color.. 277
Photography, color, camera.. 165
Photo-micrography.. 187
Pipe wrench, chain.. 37
Pistol, a curious.. 379
Plague at Honolulu.. 164
Planters, attachment for.. 228
Platform, rotating.. 260
Plow, Jones'.. 356
Potato hiller, new.. 132
Profile recorder.. 293
Propeller shaft, repair.. 68
Pulley, hoisting, new.. 374
Pump, air, electric.. 324
Pump, electric, powerful.. 20
Pumping engines.. 185

Q

Quadricycle, auto.. 104

R

Radio-active matter, exper.. 150
Rail tester, trolley.. 292
Rail wagon, Bonner.. 25
Rails, creeping, anchor for.. 149
Railway, single rail.. 280
Railway tie, metallic.. 6
Rake, sulky attachment.. 390
Reaping machine, early.. 75
Rein support for harness.. 198
Revolver, curious.. 379
Rods and cords, Chinese.. 170
Rotator, electro-magnetic.. 42
Runabout, Loomis'.. 89

S

Salt, manufacture of.. 357, 358
San Jacinto earthquake.. 27
Sault power canal.. 328
Sault Ste. Marie, map of.. 329
School, trade, cotton.. 337, 342
Seabirds, value of.. 266
Seal fish, bones of.. 107
Searchlight plant.. 72
Shaft, propeller, repair.. 68
Shag rock, removal.. 186
Sharks, Pacific.. 331
Shields for infantry.. 340
Shikishima, battleship.. 264
Ships' bottoms, cleaning.. 100
Shotgun cleaner, a.. 378
Shutter fastener, new.. 165
Siberian building, Paris.. 369
Silver ores, assay of.. 341
Sledge, foot power.. 52
Snow bank, Laramie.. 153
Snow-plow car, electric.. 153
Stassano process.. 68
Station, 70,000 horse power.. 17, 26
Statue of Col. Thayer.. 392
Steamer, paddle, Amgoon.. 200
Stela, great.. 169
Sterilizer, instrument.. 310
Stock yard, Bethlehem.. 312
Storage battery motor.. 340
Storeroom beetle.. 347
Stove and furnace combined.. 149
Street of Nations, Paris.. 344
Suffern, battleship.. 184
Sulky rake attachment.. 390
Sun, eclipse of.. 376
Sun, eclipse of the.. 360
Susa, excavations at.. 169
Swamp, Dismal.. 249
Sweep, aerial.. 260
Switch, oil, pneumatic.. 26
Switching system.. 136

T

Tautener, wire.. 133
Telegraph, Pollak & Virag.. 238
Telephone, farmer's.. 196
Telephony, long distance.. 346
Thayer, Col., statue of.. 392
Thermometer, milligrade.. 170
Thread cutter, mechanical.. 196
Tie, railway, metallic.. 6
Tightening slack wires.. 133
Tool grinding machine.. 22
Torpedo practice.. 151
Tour du monde, Paris.. 369
Toy, ingenious, an.. 228
Traction engine for Siberia.. 276
Train, experimental.. 356
Train, hospital.. 180
Transplanting buds.. 122
Tree buds, transplanting.. 122
Trench digging machine.. 281
Trolley, automotor.. 219
Trolley rail tester.. 292
Trolley wire hanger.. 244
Trousers clasp, simple.. 22
Try-cock for boilers.. 181
Tugela bridge.. 116
Tunnel, rapid transit.. 69, 70
Turbines, steam.. 248
Turrets of Kearsarge.. 225, 230
Typewriter, inexpensive.. 197
Typhlowolge Rathbuni.. 107

U

Unloader, ore.. 7
United States exhibit, entrance.. 374

V

Valve gear for engines.. 276
Valve, steam radiator.. 404
Vehicle, motor wheel for.. 11
Velocipede, mono-rail track.. 298
Vending machine, new.. 378
Vessel, floating with acetylene.. 261
Vessels, propulsion of.. 213
Vulture, California.. 171

W

Wagon, armored.. 388
Wagon, rail.. 25
Warships, recent armament.. 41
Water cooler.. 309
Water, drinking, Brooklyn.. 404
Water raising apparatus.. 122
Weapon, a historic.. 379
Weeding machine.. 292
West Point Academy.. 385, 392
Wharf at Pango Pango.. 139
Windmills, Nebraska.. 24
Window blind fastener.. 165
Window guard.. 292
Window mirror.. 262
Wire hanger, simple.. 244
Wire stretcher, Kimmel's.. 133
Wood mosaic.. 341
Woodward, Robert Simpson.. 403
Working drawings, printing.. 235
Wrench, Coleman.. 395
Wrench, pipe, chain.. 37

X

Xiphopages, the.. 113

Y

Yacht Mineola.. 373
Yews, curious forms of.. 229

Z

Zoological Park, New York.. 3, 10
Zulus of South Africa.. 57

MISCELLANY.

Figures preceded by a *star* (*) refer to illustrated articles.

A

Academy of Sciences.. 259
Academy, West Point.. *392
Academies, Association of.. 83
Accumulator suit, important.. 199
Accumulators, tests of.. 117
Acetylene, detonation, velocity of.. 247
Acetylene, explosive side.. *8
Acetylene for autocars.. 212
Acetylene for raising vessels.. *261
Acetylene gas explosion.. 387
Acetylene generator, an.. *84
Acetylene generators.. 185
Acetylene lamp, Baldwin.. *394
Acetylene, limiting percentage.. 231
Acetylene notes.. 166
Acetylene, purification.. 280
Acid, boric, compounds.. 216
Acid, hydrocyanic, in plants.. 295
Acropolis of Susa, excav.. *169
Admiralty board, naval.. 179
Aeronautics, practical.. *117
Aeronautics, progress in.. 281
Aeronauts, prize for.. 283
Africa, South, natives of.. *56
Agordat, torpedo cruiser.. 247
Agriculture at Exposition.. 310
Agrostological work.. 204
Air compression, hydraulic.. 263
Air, dissociation of.. 147
Air, liquid, experiments with.. *201
Air, liquid, facts vs. claims.. 163
Air, liquid, fallacy.. 402
Air, liquid, in blasting.. 38
Air, liquid, promotion of.. 162, 199
Air, liquid, ship propulsion by.. 214
Air pipes, cloth.. 130
Air pump, electric.. *324
Air ship, Danilewsky.. *43
Air ship test, prize for.. 216
Air ship, Von Zeppelin's.. *325
Alabaster quarries, old.. 231
Alarm, audible, by smoke.. 167
Albany, cruiser, trial of.. 34
Albany, the cruiser.. *152
Albumen prints, to clean.. 90
Alcohol from plants.. 59
Alcobol from wood.. 324
Aldehyde, formic, note on.. 391
Alexandre III. bridge.. *149
Algeria, archeolog. explor.. 150
Alloy, new, magnalium.. 91
Alloys, nickel, strength.. 166
Alloys of Japanese bronzes.. 311
Almanac, nautical, German.. 311
Aluminium prod. 1899.. 151
Amalfi, landslide at.. *6
Amber trinkets, Trojan.. 295
Ambulance, automobile.. *148
Ambulance, electric.. 103
American experiment stations.. 178
Anchor for rails.. *149
Animal body, temp. in fasting.. 262
Animals, African, protection.. 327
Animals, farm.. 168
Anthocyan, color of.. 103
Antiseptics for wood.. 51
Ants, hearing of.. 91
Applications, forfeited.. 8
Arc, electric, actinic intens.. 247
Archæological news.. 295, 361
Archæology, 1899.. 5
Architecture, landscape.. 121
Argive Heræum, excavations at.. 198
Argon, solubility of.. 282
Arid regions, clothing the.. 186
Armorclad Marshal Deodoro.. *184
Armor manufacture.. 358
Armor-plate fiasco.. 410
Armor plate fiasco, the.. 370
Armor plate for coffins.. *314
Army stretcher, new.. 343
Asbestos mines, Canada.. *213
As others see us.. 58
Asteroid, a new.. 391
Assay commission methods.. 307
Assay of gold and silver ore.. *341
Audrol developer.. 26, 355
Auroch, horn of, discovery.. 360
Autocars, acetylene for.. 212
Auto electric air pump.. *324
Auto-quadricycle.. *104
Automobile, 1899.. 5
Automobile accident, decision.. 263
Automobile accidents.. 170
Automobile affairs in England.. 230
Automobile ambulance.. *148
Automobile and horse, cost.. 50
Automobile Club of America.. 22
Automobile Club, tour of.. 342
Automobile competition Engl.. 135
Automobile cup race.. 390
Automobile delivery.. 135
Automobile, duty on the.. 250
Automobile Expos., Nuremberg.. 391
Automobile for doctors.. 278
Automobile literature.. 394
Automobile, military.. *408
Automobile news.. 22, 38, 55, 76, 103, 124, 135, 170, 230, 250, 263, 279, 291, 311, 330, 362, 391, 407
Automobile omnibus.. *245
Automobile patrol wagon.. *148
Automobile race.. 230
Automobile race, American.. 259
Automobile races, Antwerp.. 391
Automobile races, France.. 291
Automobile regulations, Paris.. 103
Automobile runaway, an.. 54
Automobile service, London.. 250
Automobile show.. *89
Automobile show in New York.. 263
Automobile, the alcohol.. 391
Automobile, the ideal.. 130
Automobile Transportation Co.. 230
Automobile trip to Klondike.. 263
Automobile trolley, French.. *219
Automobile trouble, Paris.. 391
Automobile wagons for Africa.. 103
Automobile, war, prize.. 230
Automobiles, comparison.. 132
Automobiles in French army.. 230
Automobiles, military.. 278, 310
Automobiles, three types of.. 195
Automobilism, postal.. 210
Automobilists, attire for.. 103

B

Bacteria, resistance of.. 247
Bacteria, the, of old.. 391
Bait, fresh, storage of.. 311
Ball-bearing gun.. *218
Balloon air ship, Danilewsky.. *43
Balloon ascensions, Paris.. 59
Ballooning, progress in.. *117
Banyan tree, St. Kitts.. *91
Bath, electric light.. 151
Bath, photo., reinforcing.. 21, 117
Battery, new storage.. *261
Battery, new type of.. 340
Battery, storage, suit.. 199
Battleship Georgia.. *361
Battleship of the future.. 386
Battleship Petropavlovsk.. *308
Battleship Shikishima.. *264
Battleship Suffern.. *184
Battleships, last year's.. 194
Becquerel, experiments of.. 106
Bedhangings, Madagascar.. 327
Beech for sleepers.. 343
Beet sugar industry.. 147
Beetle, store room.. *347
Ben Nevis Observatory.. 198
Beryl crystal, a large.. 343
Bethlehem steel works.. *358
Bicycle, 1899.. 5
Bicycle, cushion frame.. *37
Bicycle, half a century of.. *88
Bicycle motor equipment.. *132
Bicycle, use on railway tracks.. 279
Billiard ball, breakage of.. *58
Billion dollar country.. 163
Bills, impossible, two.. 322
Birds, protection of.. 51, 327
Birds, sea, value of.. *266
Blackwall tunnel, the.. *217
Blast, submarine, great.. *308
Blue print machine.. 87
Blunder, geographical.. 229
Boat races on the Seine.. 231
Boat, revolving, Canadian.. *213
Boat, submarine, Raddatz.. 23
Boats, roller.. 71
Boers, origin of the.. 311
Bookworm, the.. *347
Book, curved pages vs. sight.. 375
Books, our, in 1899.. 98
Borax, Californian.. *326
Boreholes, deep.. 282
Botany, divisions of, work.. 155
Bottle, non-refillable.. *212
Bottles, siphon, danger from.. 204
Bowles, Francis T.. *137
Brake, air, patent.. 216
Bridge, Alexandre III.. *149
Bridge, Boston and Cambridge.. 23
Bridge, Brooklyn, model of.. 167
Bridge building.. 116
Bridge, East River.. *52, *294
Bridge, lift, rolling.. *376
Bridge, memorial, Paris.. *313
Bridge, memorial, Potomac.. *313
Bridge, Tugela.. *116
Bridges, cantilever.. 219
Bridges, Mississippi.. *168
Bromide paper, for amateurs.. 296
Bronzes, Japanese, alloys.. 311
Buds, transplanting.. *122
Buffalo, extermination of.. 8
Buffalo, water, employing the.. 99
Building improvements, N. Y.. 87
Buildings, carriage by water.. *154
Burner for incandes. mantles.. *212
Butter, packing in glass.. 260

C

Cab, electric, in Paris.. *345
Cabs, electric, Boston.. 135
Cable, American Pacific.. 98
Cable insulator, new.. 359
Cable, submarine, first.. *388
Cables, East River bridge.. *52
Calcium carbide, breaking.. 281
Camera for natural colors.. *165
Camera, Kodak, inventor of.. 202
Camera, Kromskop.. *277
Camera, panoramic.. *282
Canal bill, Nicaragua.. 82, 290
Canal boat traction, electric.. 39
Canal, Cape Cod, the.. 87
Canal commission, President's.. 338
Canal, drainage, Chicago.. 99, *105
Canal, Erie, improvement.. 210
Canal, Erie, locks.. *74
Canal, Erie, problem.. 66
Canal, Isthmian.. 34
Canal, Isthmian, survey.. 194
Canal, Nicaragua, dams.. 199
Canal, Nicaragua, level.. 88, 86
Canal, power, Sault.. *328
Canal problem, Isthmian.. 124
Canal, Soulanges.. 247
Canals, census inquiry into.. 187
Cantilever cranes.. *85
Cantilever bridges.. 290
Caoutchouc in Brazil.. 91
Caoutchouc in South America.. 122
Cape Cod canal, the.. 87
Cape Nome, emigration to.. 322
Cape Nome gold deposits.. *315
Cape Nome gold fields.. 290
Cape Nome, mining at.. 67
Car accident, curious.. 391
Car, a dynamometer.. 170
Car fender, a new.. *343
Car, armorclad, Lincoln's.. 198
Car, motor, exhibition.. 362
Car, shouldering.. *324
Cars, buffet.. 103
Cars for Trans-Siberian railroad.. 87
Cars, motor, military.. 320
Carabao, employing the.. 99
Caravans, tea.. 203
Carbons, electric light.. 52
Carborundum, manufacture.. *377
Carriage, motor, military.. *59
Carriage, motor, novel.. 22
Carriage, motor, Winton.. *229
Carriage, steam, locomobile.. *54
Carthage, excavations at.. *73, 183
Catacombs, exploration.. 295
Cathedral, Milan, new facade.. 215
Cats, mummified.. *361
Celery and typhoid fever.. 183
Cells, secondary, dry.. 279
Cements, note on.. 231
Census inquiry, canal.. 187
Centuries, memorial of.. 170
Century, the new.. 18
Chamberlin, W. H.. *250
Chemical growth.. 155
Chemistry, 1899.. 5
Chemistry, division, work.. 162
Chemistry, modern, needs of.. 322
Chicago drainage canal.. 99
Chicory culture in West.. 9
Chimney, brick, overthrow.. 55
Chimneys, tall, felling.. *372
China, business transaction.. 307
Christmas-tree trade.. 151
Chromium and nitrogen diox.. 20
Church edifice, unique.. 52
Church, vitrified clay.. 188
City transportation.. 50
Clark, Jonas G.. 339
Cliff dwellers, mummies of.. *203
Cliff dwellings, discovery of.. *40
Clinker, utilization of.. 135
Clock, a meteorological.. 323
Clock, checking, employes'.. 135
Cloth, khaki.. 26
Clouds, curious things in.. 387
Clutches, magnetic.. *100
Coal-cutting mach., electric.. *389
Coal mining, electrical.. *389
Coal mining town, model.. 155
Coal production, our.. 148
Coccanuts, fungus of.. 104
Coffins, armor plate for.. *314
Coherer, an automatic.. 376
Coin-in-the-slot machine.. *378
Color photography.. 211, 338
Color-photography, Ives syst.. *277
Combat, naval, miniature.. 327
Commerce and industry, depart.. 226
Commerce of Great Lakes.. 150
Commerce of U. S., foreign.. 83
Compass, a simple.. *260
Conduits, grounding.. 330
Coues, Elliott, death of.. 9
Confectionery in army.. 6
Congress, history of science.. 219
Congress, international.. 363
Congresses at Paris.. 164, 284
Consular reform.. 146
Copper industry, our.. 294
Copper iodide reactions.. 122
Copper mine, Arlington.. 87
Copyright in United States.. 164
Copyright of photographs.. 102
Cordite factory in India.. 279
Corn crop, Kansas.. 164
Corn killer, new.. *132
Cotton fabrics, Southern.. 322
Cotton, great future of.. 243
Cotton picker, mechanical.. *330
Cotton, shipping, method.. *120
Cotton trade schools.. 342
Crane, cantilever.. 214
Crane, traveling, accident.. 391
Crane, traveling, Paris Expos.. 227
Cranes, cantilever.. *85
Criterium race, fourth.. 362
Crops in 1899.. 67
Croton dam, new.. *36
Cruiser Albany, the.. *152
Cruiser Albany, trial of.. 34
Cruisers, high-speed, foreign.. *405
Cruisers, last year's.. 194
Cruisers, United States, new.. 214
Cullum Memorial Hall.. 262, *392
Culture, electro, experiments.. 315
Culverts, metal, Congo R.R.. 87
Cuprene, hydrocarbon.. 243
Curtain hanger.. *310
Cushing, F. H., death of.. 243

D

Daimler, Gottlieb, death of.. 279
Dam at Austin, failure.. *265
Dam, Croton, new.. *36
Dam, the Austin.. 299
Dams of Nicaragua canal.. 199
Day, when it changes.. 329
Death Valley, California.. *309
Debris, impounding, Yuba river.. 264
Decision, a wise.. 50
Deck, elevating, ferryboat.. *216
Depilatory, X-rays as a.. 153
Dispatches, simultaneous.. 215
Detonator for mines.. *330
Developer, photo., new.. 26
Developer, the latest.. 355
Developing bath, hypo in the.. 267
Diamond mines, Kimberley.. *57
Diamonds, black.. 372
Diamonds, great.. 90
Dishwashing machine.. *116
Dismal Swamp, the.. *249
Distance and speed.. 82
Ditch-digging machine.. *281
Diving for zoolog. specimens.. *395
Divining rod, use of.. 214
Dock, floating, 700-foot.. *248
Docks, dry, floating, N. Y.. 275
Door closing device.. 151

Double turret system, trial..... 226
Drainage canal, Chicago..... *105
Draughtsman, mechanical..... *228
Drawbar tests..... 295
Drawings, perspective, app..... *228
Drawings, working, printing..... *235
Drier for meats, etc..... *356
Driftwood on Alaska coast..... 139
Driving gear, elevator..... *165
Drugstore beetle..... *347
Duke of Argyll, death of..... 275
Dunes of Gascony..... 324
Dust, a fall of..... 343
Dust in mines, prevent..... 261
Dwelling, attractive..... *363
Dwellings, cliff, discovery of..... *40
Dynamite explosions, severe..... 198
Dynamometer car, a..... 170
Dynamos, large, at Expos..... 227

E

Earthquake, Campagna..... 359
Earthquake measurement..... 314
Earthquake, San Jacinto..... *27
Earthquake, San Jacinto Mt..... 267
Earthquake sounds..... 135
East River bridge..... *294
Eclipse, coming..... *244
Eclipse, observations on..... *330
Eclipse of sun, the..... 354
Eclipse, shadow bands of..... 375
Eclipse, solar, the..... *376
Egg shell membrane, use for..... 262
Egleston, Prof., death of..... 51
Electrical notes 23, 39, 71, 87, 119, 151, 167, 183, 215, 230, 247, 279, 295, 311, 359. 407
Electricians, registration..... 167
Electricity, 1899..... 4
Electricity, developments..... 340
Electricity, emblematic, pict..... 149
Electricity from snow storm..... 139
Electricity in conveyance..... 306
Electricity, supply by gas co..... 371
Electricity, tariff on..... 39
Electro-culture experiments..... 315
Electro-magnet rotation..... *42
Electro-magnetic machine..... *68
Element, new, victorium..... 197
Elephant, Jumbo..... 43
Elevator controller, mine..... *244
Elevator driving gear..... *165
Elevators, grain, Chicago..... *232
Elevators, overcrowding..... 215
Elk, destruction of..... *171
Emigrants from Germany..... 22
Empire, our..... 4
Emulsion, photo..... 127
Engine, oil, improved..... *21
Engine, oil, in Palestine..... 341
Engine, rope armored..... *312
Engine, traction, armored..... *388
Engine, traction, for siberia..... *276
Engine valve gear..... *276
Engineering, civil..... 4
Engineering, mechanical..... 4
Engineers, civil, in session..... 51
Engines, gas, for ships..... 327
Engines of the Viper..... *248
Engines, oil, in Palestine..... 327
Engines, pumping, navy yard..... *185
Engines, steam, novel form..... 181
Engines stopping, device..... *84
Engineering notes 7, 23, 39, 55, 87, 103, 119, 135, 150, 167, 198, 215, 231, 247, 263, 279, 311, 327, 343, 375, 391, 406
Entomology, Division, work..... 210
Erie Canal locks..... 74
Erie Canal problem..... 66
Esparto grass, lye from..... 262
Ethyl alcohol..... 324
Eulalias, Japanese..... 339
Excavations at Carthage..... *73
Excavations at Susa..... 66
Excavations of Ur..... 214
Exhibition at Canea..... 185
Exhibition, book industry..... 327
Expansion, commercial, science..... 402
Expedition, North Pacific..... 184
Expedition, relief, Peary..... 390
Exploration in 1899..... 187
Explosions, dust, in mines..... 261
Explosions, effect on air..... 375
Exports for 1899, our..... 4
Exports, phenomenal, our..... 370
Exposition, automobile, Belgian. 330
Exposition, entrance to..... 243
Exposition, illumination of..... 87
Exposition notes 227, 250, 259, 275, 291, 310, 327, 339, 362, 371, 390
Exposition, official catalogue..... 9
Exposition, Pan-American..... 51
Exposition, Paris..... 258, *344
Exposition, Paris, attractions..... *374
Exposition, Paris, perspectives *101, 406
Eye, relief by typewriter..... 198
Eye, removing substances..... 410
Eyesight of school children..... 86

F

Factory inspection, N. Y..... 99
Farm animals..... 168
Fence, electric..... 71
Fences, wire, economy of..... 183
Fencing against snow..... 39
Fender, car, new..... *343
Ferris wheel, the..... 262
Ferry steamer, a..... *216
Fever, typhoid, and celery..... 183
Fiber cleaning machine..... *276
Filtration plant, Albany..... *182
Fish, electric, of the Nile..... 18
Fish, new, for food..... 75
Fish poisoning, San Francisco..... 279
Fish scales, utilization..... 119
Fishes, psychology of..... 59
Fishes, some Pacific..... *331
Flagship, Farragut's..... *53
Flash, green, sunset..... 67
Flashes, dark, existence of..... 215
Flashes, smokeless, sighting..... 86
Flashlight signaling..... 123
Flat irons, electric..... 183
Flying machine, new..... *43
Fly screen and window guard..... *292
Food, adulteration of..... 247
Food preservation..... 292
Food products, adulteration..... 190
Fore carriage, automobile..... *89
Forest fires, note on..... 134
Forest, petrified, Arizona..... 246
Forest preservation..... *393
Forester, U. S., work of..... 292
Fort Ancient, old..... 104
Forum, excavations..... 295
Forum, Roman, the..... 327
Fossils, great collection..... 9
Fossils, unearthing..... 19
Fountain, electric, novel..... 327
Fountaine Marchand, Paris..... 279
Fox breeding, Alaskan..... 242
Fuel, feed, boiler..... *116
Fuel, waste as..... 114
Fuels, two new..... 375
Fulton, tomb of, new..... 76
Fungus of cocoanuts..... 104
Furnace and stove..... *149
Furnace, electric, litigation..... 386
Furnace, electric, Stassano..... *68
Furnaces, automatic feed..... *116
Furnaces, blast, oil in..... 135
Furnaces, smoke consuming..... *196

G

Galvanism for stings..... 359
Garden, Botanical, N. Y..... 55
Gascony, dunes of..... 324
Gas, acetylene, explosion of..... 387
Gas engines for ships..... 327
Gas liquor, utilization..... 215
Gas, luminosity of..... 183
Gas, natural, duty on..... 213
Gases, absorption spectra..... 359
Gasoline drunkards..... 23
Gasoline gun carriage..... *59
Gear, reversing, novel..... *100
Gear, valve, engine..... *276
Geography in 1899..... 187
Geological Soc, American..... 19
Georgia, battleship..... *361
Germany, emigrants from..... 22
Geyser activity, decline of..... 60
Gibier, Dr. Paul, death of..... 387
Glass for butter packing..... 260
Glass vessels, hollow..... 246
Globe Celeste, Paris Ex..... 227
Globe, celestial, Paris..... *374
Globes, illuminating, comparis..... 215
Glycin, red, sensitizer..... 362
Gold and lead, mingling of..... 370
Gold deposits..... *315
Gold fields, Cape Nome..... 290
Gold mining, Cape Nome..... 67
Gold ores, assay of..... 341
Gold, production of..... 114
Gold saving machine..... *315
Golf balls, statistics..... 86
Goods, Amer., in Russia..... 34
Gordon Bennett cup race..... 135, 229
Grain, water carriage..... *232
Grape belt, product of..... 118
Grass, esparto, lye from..... 262
Grasses, Japanese..... 339
Grasses, work on..... 204
Greely, A. P., resignation of..... 210
Guard, machine..... *37
Gulls, extermination..... 21
Gun, automatic, Colt..... *229
Gun carriage, gasoline..... *59
Gun cleaner, a..... *378
Gun construction, curiosity..... *218
Gun, rifled, Cullen..... *218
Guns and armor, manufacture..... *312
Guns, British and Boer..... 35
Guns, manufacture of..... *358
Guns of the Boers..... 23
Guttapercha substitute..... 395

H

Hair removal, electric..... 153
Half-tone work, feat in..... *155
Hak i' th' wood, Bolton..... 130
Hambler, James..... 59
Hammer, foot-power..... *52
Hammond, Wm. A., death of..... 39
Hand and machine production..... 146
Hare, Belgian, raising..... *134
Hartford, U. S. S., reconstruct..... *53
Hay rake attachment..... *390
Hazen, H. A., death of..... 119
Headlight effects, electric..... *371
Headlights, twin..... 375
Heat insulators, efficiency..... 311
Heat radiation of stars..... 36
Heart shields, steel..... 198
Heavens in April..... 195
Heavens in July..... 403
Heavens in June..... 323
Heavens in May..... 275
Helium, solubility of..... 282
Hemp, Manila..... 24
Hibernation, human..... 37
Horse and automobile, cost..... 50
Horse, trotting, American..... 339
Horses, Amer., purchase of..... 276
Horseflesh in America..... 147
Hose, metallic, flexible..... 262
Hose, metallic, in mining..... 262
Hospital train for Africa..... *180
House, apartment, novel..... 168
House moving by water..... *154
Houses of Navahos..... *223
Hughes, Prof. D. E., death of..... 67
Hughes, Prof., estate of..... 214
Huxley, statue of..... 343
Hydrogen, solidification of..... 250
Hydrophobia inoculations..... 22
Hypnotism, congress of..... 359
Hypo in the developing bath..... 267

I

Ibis, the..... *72
Ichthyology, curiosities..... *107
Illumination of Exposition..... 339
Illumination of Pan-Amer. Exp. 262
Illusion, Chinese..... *170
Immigrants of 1899..... 71
Immigration in 1899..... 186
India rubber, absorption..... 215
India rubber in S. America..... 122
India rubber nails..... 151
India rubber, new source..... 231
India rubber of Sierra Leone..... 215
Infantry, shields for..... *340
Insect pest, new..... 42
Insects as food..... 71, 299
Instruments, decimal, naval..... 148
Insulator, cable, new..... 359
Invention, finality in..... 258
Inventions recently patented, 12, 28, 44, 60, 76, 92, 108, 124, 140, 156, 172, 188, 204, 220, 236, 251, 267, 284, 299, 316, 332, 348, 364, 379, 395
Inventor, a generous..... 202
Inventor, noted, death of..... 179
Inventor, warning to..... 35
Inventors and Brit. War Office..... 208
Inventors, protection of..... 38
Invertebrates, new..... 24
Iodine in sea water..... 280
Iron and steel exports, our..... 211
Iron, pig, casting..... 118
Iron, pig, sampling..... 279
Iron production, Stassano pro..... *68
Iron works, Krupp..... 292
Irons, smoothing, electric..... 71
Irrigation areas, growing..... 131

J

Japan, trade with..... 86
Jewelers, women, Manila..... 408
Jewelry at Exposition..... 339
Jumbo, the elephant..... 43

K

Kaiserin Maria Theresia..... *197
Kaiser Wilhelm, record..... 35
Kearsarge, turrets of the..... *230
Khaki cloth..... 26
Knossos, excavations at..... 307
Knots, term, use of..... 86
Kodak camera, inventor of..... 202
Kromskop camera..... *277
Kromskop, improved..... 146

L

Labor, hand, vs. machinery..... 103
Labor, unit of..... 22
Ladder, fire, self-launching..... *404
Lake Nicaragua, level..... 115
Lake Nicaragua, shrinkage..... 306
Lakes, great, commerce of..... 150
Lamprey, three-toothed..... *235
Lamp, acetylene, Baldwin..... *394
Lamps, collection of..... 35
Lamps, incandes. laboratory..... 151
Lamps, incands., temperature..... 215
Landslide at Amalfi..... *6
Lantern slides, toning..... 179
Lantern work, needs of force..... 86
Launches, electric, Venice..... 196
Lawn grasses, Japanese..... 339
Legislation, foolish..... 34
Lens, tele-photo..... 355
Leprosy treatment of..... 231
Librarian, Congress, report..... 154
Library, music, Geneva..... 183
Library, public, New York..... 86
Life-saving competition..... 244
Light, effect on chemicals..... 123
Light of illuminated room..... 86
Light, search, fire..... *72
Lighting, train, electric..... 130
Lightning, death by..... 311
Lightship, steam, electric..... 166
Lignite mines, new..... 391
Lime, action on land..... 121
Liquids, raising, apparatus..... *122
Liquids, sterilizing, electric..... 183
Lithography, stone for..... 283
Livingstone, relics of..... 87
Locks, pneumatic, canal..... *74
Locomobile, the..... *54
Locomotive, armored..... *388
Locomotive, protected..... *212
Locomotive, rope armored..... *212
Locomotives, Amer., in Germany 213, 290
Locomotives, Amer., study of..... 215
Locomotives, cent. of gravity..... 330
Locomotives, compound..... *101, 348
Locomotives, freight, American. 199
Locomotives, petroleum..... 395
Loomis motor, the..... *89
Lubricator, automatic, Bangs'..... *22
Lumber hoisting pulley..... *374
Luncheons in schools..... 139
Luzon, volcanic eruption..... 279
Lyddite..... 39
Lyddite const. in milk..... 90
Lye from esparto grass..... 262

M

Machine, electro-magnetic..... *68
Machinery and Russian peasant..... 66
Magnalium, properties..... 91
Magnet, electro, rotation..... *42
Magnetism of the earth..... 35
Mail matter, second-class..... 114
Malaria and mosquitoes..... 386
Mantles, incandes., burner for..... 212
Map, gigantic..... 21
Map, weather, how made..... *38
Marble, elasticity of..... 375
Marble, photographing on..... 292
Marine, merchant..... 5
Marine, merchant, revival..... 272, 278
Marshal Deodoro, armorclad..... *184
Match industry, Swedish..... 231
McCormic, L. J..... 154
Meat for manure..... 183
Meats, white and dark..... 276
Melinite..... 39
Memorial Hall, Cullum..... *392
Memorial hall, West Point..... 262
Mercury extraction, electric..... 23
Metallurgy, experiments..... 250
Metals, precious, production..... 83
Meteorite, Peary..... 212
Meteors, fall of, 1899..... 39
Metric system for the U. S..... 135
Metric system in Russia..... 343
Milk, age of, determination..... 23
Mill engine, disappearance..... 391
Milne-Edwards, death of..... 279
Mine detonators..... *330
Mine elevator controller..... *244
Mines, asbestos, Canada..... *213
Mines, diamond, Kimberley..... *57
Mines, dust in, prevent..... 261
Mines of Mt. Sinai..... 134
Mineola, yacht..... *373
Mining at Cape Nome..... 67
Mirror, window..... *262
Mivart, St. George, death of..... 247
Mohawkite, new ore..... 282
Molybdenum, bisulphide..... 106
Monte Baldo, disturbauce in..... 262
Moon, the, in April..... 195
Moon, the, in June..... 323
Moon, the, in May..... 75
Mortar, a new..... 231
Mosaic, wood..... *341
Mosquito, malarial, experiment 386
Mosquitoes, destruction of..... 375
Motor, bicycle, equipment..... *132
Motor, carriage, military..... *59
Motor carriages, race of..... 269
Motor for land and sea traction 310
Motor, hydraulic, a..... *363
Motor, storage battery..... *340
Motor, the Loomis..... *89
Motor-wheel, vehicle..... *11
Motors, alcohol..... 391
Motors, gas, for ships..... 327
Mountain sickness..... 279
Mount Sinai, mines of..... 134
Movements, vertical, registry..... 215
Mowing machine, early..... *75
Mummies, American..... *203
Mummies of cats..... *361
Museum, children's..... *296
Museum of fine arts, Boston..... 55
Music library, Geneva..... 183

N

Nails, India rubber..... 151
Nails, wire, objection..... 188
Name center of the brain..... 9
Naphtha of Saghalin Island..... 202
Navahos, houses of..... *233
Navel oranges..... 326
Naval programme of Germany..... 194
Naval progress, 1899..... 5
Navy, admiralty board..... 179
Navy vessels, models of..... 104
Navy Yard, New York..... *138
Nebuchadnezzar, palace of..... 18
Necrology, 1899..... 5
Need, national..... 306
Negatives, intensification..... 92
New Siberian island, explora..... 55
New York, water supply of..... 178
Nicaragua canal bill..... 82, 270
Nicaragua canal dams..... 199
Nicaragua canal level..... 83, 86
Nicaragua, lake, level..... 115
Nicaragua, lake, shrinkage..... 306
Nickel alloys, strength..... 166
Nickel ore, a new..... 282
Nicotine in horticulture..... 308
Nitrogen dioxide, action..... 20
Nobel prizes..... 118
Nodes and loops..... *84
Nut lock, new..... *132

O

Observatory, Ben Nevis..... 198
Ocean temperature, deep..... 166
Ocean, temperature of..... 261
Office building, model..... *228
Oil engine, improved..... *21
Oil engine in Palestine..... 343
Oil in blast furnaces..... 135
Oil, olive, where formed..... 391
Oil, Russian, in Germany..... 343
Oil switch, pneumatic..... *26
Olive crop, failure of..... 91
Olive oil, where formed..... 391
Omnibus, automobile..... *245
Ophir, situation..... 43
Oranges, seedless..... 326
Ore, nickel, new..... 282
Ore smelting, electric..... 359
Ore unloader, new..... *7
Orograph, the..... *293
Orvieto, tombs at..... *379
Ostia, port of Rome..... *409
Oxide, carbonic, and plants..... 26
Ozonizer, new form of..... 343

P

Paintings, durability..... 134
Paintings of the Roman period..... 297
Palace, ducal, of Venice..... 343
Palace, Electrical, Paris..... 390
Palace, Horticultural, Paris..... 390
Palace of navigation, Paris..... 374
Palestine exploration..... 278
Palisade preservation..... 35
Palisades, preservation..... 247
Panama canal..... 84
Pan-American exposition..... 51
Pan-American expos. illuminat..... 262
Pango Pango, wharf..... *139
Paper, bromide, for amateurs..... 298
Paper famine, England..... 119
Paper, feeding to the press..... 39
Paper, photo., emulsion for..... 122
Paper, platinotype..... 117
Paris-Roubaix races..... 343
Paris, travel to..... 51
Park, national, proposed..... 55
Park, zoological..... *10
Passion play, Oberammergau..... 87
Paste for photo. prints..... 340
Patent bills, vicious..... 322
Patent decision, remarkable..... 98
Patent law, Japanese..... 391
Patent office, change in..... 210
Patent office exhibit..... 211
Patent office report, English..... 378
Patents, annual report..... 146
Patents, assist. commiss..... *250
Patents, high court of..... 82
Patents of 1899..... 311
Patrol wagon, automobile..... *148
Pavement, asphalt, breaker..... 376
Pavements, noise on..... 185
Peabody, George, gifts of..... 231
Peanut industry..... 243
Peary meteorite..... 212
Peary relief expedition..... 130, 390
Penny-in-the-slot machines..... 391
Pepper, J. H., death of..... 211
Petit-caves..... 195
Petit-Caves, aid for..... 195
Petrel, new species of..... 375
Petroleum deposits, new..... 202
Petroleum pipe line..... 114
Petroleum pipe line, Russian..... 111
Petroleum production, Russian..... 108
Petropavlovsk, battleship..... *308
Pharmacy, a model..... 9
Phonograph, new type..... 362
Phosphate deposits..... 314
Photographic congress..... 282
Photographing on marble..... 292
Photographs, copyright of..... 102
Photography, aerial..... *314
Photography, color..... 211, 338
Photography, color, Ives syst..... *277
Photography, congress of..... 18
Photography, father of..... 130
Photography in colors..... *165
Photo-micrography..... *187
Physicians, women, Russian..... 183
Physics, chemical, experiments..... 370
Pine needles, utilized..... 119
Pipe line for sugar juice..... 170
Pipe line, Russian..... 114, 391
Pipe-wrench, chain..... *37
Pipes, air, cloth..... 130
Pipes, water, glass lined..... 343
Pistol, a historic..... *179
Plague, Asiatic, Honolulu..... *164
Plague, bubonic..... 132
Plague, San Francisco..... 374
Planets, the, in April..... 195
Planets, the, in June..... 323
Planets, the, in May..... 275
Planters, attachment for..... *228
Plant growth and nitrogen..... 183
Planet, intermercurial..... 155
Plants, carbonic oxide in..... 26
Plants, coloring matter..... 329
Plants, experiments on..... 107
Plants, hydrocyanic acid in..... 295
Plants, iodine absorption..... 247
Plants, temperature of..... *311
Platform, revolving..... *260
Platinotype paper..... 117
Platinum prints..... 21
Playhouse for children..... 183
Plow, Jones'..... *356
Pneumatic dispatch syst..... 338
Pole, south magnetic, finding..... 249
Pollok memorial prize..... 58
Pompeii, water system of..... 187
Postal service, Queen Anne..... 322
Posters, remarkable..... 23
Post office, U. S., at expos..... 339
Post, parcels, success of..... 234
Potassium chlorate..... 70
Potato hiller, new..... *132
Potato rot, prevention..... 23
Power plant of exposition..... 215
Power station, 70,000 horse..... *26
Printing office, government..... 99
Prints, albumen, to clean..... 90
Prints, blue, by electricity..... 359
Prints, bromide, toning..... 179
Prints, photo, mounting..... 340
Prints, platinum..... 21
Prisse d'Avannes, honors to..... 374
Prizes for scientists, French..... 227
Prizes, Nobel..... 118
Profile recorder, the..... *293
Profitable, mutually..... 338
Programme, naval, new..... 179
Projectiles, capped..... 306
Propeller shaft, repairing..... *68
Propulsion, ship, by liquid air..... 214
Propulsion, ship, problem..... *213
Publications of 1899..... 98
Puerto Rico, official spelling..... 55
Puerto Rico, plant products..... 50
Pulley, hoisting, new..... *374
Pullman, wage earners of..... 103
Pump, air, electric..... *24
Pump, electric, powerful..... *20
Pumping engines, Navy Yard..... *185

Q

Quadricycle, auto..... 104
Quaritch, Bernard, death of..... 39
Questions, photographic..... 84

R

Race, automobile..... 230
Race, automobile, American..... 259
Race, automobile cup..... 390
Race, Gordon Bennett..... *229
Race horse, American, abroad..... 338
Races, automobile, France..... 291
Races, boat, on Seine..... 231
Races, Paris-Roubaix..... 343
Raddatz submarine boat..... 23
Radio-active matter..... *151
Radiometer, new..... 71
Radium, atomic weight..... 87
Rail tester, trolley..... *292
Rail, Trans-Siberian..... 58
Rail wagon, Bonner..... *25
Rails, creeping of, Eads bridge..... *181
Rails, expansion of..... 55
Railroad, New York and Ottawa..... 215
Railroad school, a..... 198
Railroad stations, modern..... 167
Railroad systems of Asia..... 370
Railroad, Trans-Siberian..... *200
Railroad wreck, vagaries of..... *264
Railroads, mountain, electric..... 247
Railroads, steam, 1899..... 4
Railway, electric, at expos..... 291
Railway, electric, Chinese..... 71
Railway, funicular, Trieste..... 391
Railway, Kars-Erzeroum..... 87
Railway plane, inclined..... 198
Railway, single-rail..... 274, *280
Railway, single-rail, motor..... *340
Railway statistics..... 198
Railway, street metropolitan..... 338
Railway tie, Chester..... *6
Railway traction, new system..... 167
Railway, Trans-Siberian..... 258
Railways, street, Tokio..... 250
Rainbow, a purple..... 38
Rake, sulky, attachment..... 390
Range finder, electric..... 183
Rations, emergency..... 375
Ray, green, at sunset..... 67
Ray, X, fluorescent screens..... 231
Rays, X, and selenium..... 68
Rays, X, as depilatory..... 153
Rays, X, in field surgery..... 87
Rays, X, new method..... 295
Razors, disinfecting..... 119
Razors, sterilizer for..... *310
Reaping machine, early..... *75
Red River improvements..... 215
Relics, curious, Scotch..... *314
Rein support..... *198
Rescue apparatus, coal mine..... 169
Research, juvenile..... 103
Resistance for heating devices..... 359
Revolver, a colonial..... *379
Rifle, magazine, modern..... 178
Rifle ranges for cities..... 168
Roadbeds, trimming..... *324
Roads, good..... 235
Roads, good, value..... 402
Rocky Mountains, snowfall..... *133
Rod, divining, use of..... 214
Rods and cords, Chinese..... *170
Rome, discoveries in..... 295
Rome, records of, bronze..... 389
Rosin and turpentine..... 131
Round-bale cotton..... *120
Rubber extraction process..... 390
Rubber substitute, new..... 309
Runabout, Loomis..... *89
Ruskin, John, death of..... 67

S

Sabers, Japanese..... 198
Sagh alien Island, petroleum..... 202
Salt, manufacture of..... *357
Salt water detector..... 167
Sand glasses..... 246
Sanding rails..... 264
Santa Catalina aquarium..... *395
San Francisco Bay..... 114
San Francisco Bay, obstructions. *186
San Jacinto earthquake..... *27
San Jose scale, remedy..... 247
Sault power canal..... *328
Saw, electric, in surgery..... 279
Scale, San Jose, remedy..... 247
School, a railroad..... 198
School buildings, arrangements. 279
School, Volta, Naples..... 295
Schools, commercial, Chinese..... 215
Schools, cotton trade..... 342
Science for the love of it..... 290
Science, history of..... 219
Science in modern war..... 227
Science notes 9, 23, 39, 55, 71, 86, 103, 119, 135, 151, 167, 183, 198, 215, 231, 247, 262, 279, 295, 311, 327, 343, 359, 375, 391, 407
Sciences, N. Y. Acad., reception. 284
Scientists, American, honored..... 200
Screens, fluorescent..... 231
Screw propeller, Jefferson on..... 308
Sea birds, value of..... *266
Selenium and X rays..... 68
Shadow bands of eclipse..... 375
Shaft, propeller, repairing..... *68
Shafts, deep..... 262
Shag Rock, removal of..... *186
Sharks, Pacific..... *331
Shield, bullet proof..... 55
Shields for infantry..... *340
Shikishima, battleship..... *264
Ship propulsion by liquid air..... 214
Ship propulsion, problem in..... *213
Ships, battle, of future..... 386
Ships' bottoms, cleaning..... *100
Ships, screw propelled..... 197
Shipping, the world's..... 283
Shoe blackener, automatic..... 295
Shotgun cleaner, a..... *378
Show, passing, the..... *171
Shutter fastener, new..... *165
Sidewalk, the moving..... 310
Sign, illuminated, new..... 167
Silk, artificial..... 43
Silver ores, assay of..... 341
Siphons, risks of..... 204
Skies, evening, in April..... 195
Sledge, foot power..... *52
Sleeping car companies, consol..... 391
Slides, lantern, toning..... 179
Smelting, electric..... 359
Smelting furnaces, electric..... 366
Smelting, zinc, process..... 355
Smith, James G., death of..... 179
Smith, Mrs. R., death..... 100
Smithsonian Institution..... 83
Smokestacks, large..... 279
Smoking car ventilation..... 23
Smyth, Piazzi, death of..... 183
Snowfall of Rocky Mountains..... *133
Snow plow, electric..... *153
Soapstone dishes, Indian..... 215
Societies, mutual aid..... 195
Soil, effect of salt water..... 9
Soldier, invisibility of..... 90
Sorghum sirup..... 89
Soulanges canal..... 247
South America, trade with..... 390
Spain, pavilion at Expos..... 339
Spectra of gases..... 359
Speed and distance..... 82
Sponges, artificial..... 151
Stage effects, old..... 187
Stamps in book form..... 151
Star in nebula of the Lyre..... 231
Star, variable, in Algol..... 148
Stars, heat radiation of..... 36
Stars, heat radiation of..... 71
Stassano process..... 68
Statue of Huxley..... 343
Steam carriage, locomobile..... *54
Steamships, freight, large..... 327
Steamships now building..... 131
Steel and iron exports, our..... 211
Steel balls, manufacture..... 231
Steel balls, sorting..... 151
Steel bit, removal from hole..... 31
Steel of Japanese swords..... 198
Steel ties, use of..... 87
Steering of ships..... 194
Sterilizer, instrument..... *310
Stigma, secretion of the..... 198
Stoker for furnaces..... *116
Stonehenge..... 67
Stone, lithographic, German..... 283
Stone, lithographic, imitation..... 359
Stones, floating..... 283
Storage battery motor..... *340
Storeroom beetle..... *347
Storm, great, in Paris..... 394
Stove and furnace..... *149
Street cars, fender for..... *343
Street crossing in New York..... 135
Streets, paved, New York..... 343
Stretcher, army, new..... 343
Strontium sulphide..... 75
St. Andrews Rapids..... 103
Suez canal traffic..... 375
Suffern, battleship..... *184
Sugar, world's supply of..... 147
Sulky rakes, attachment..... *390
Sulphur fluorides, the..... 387
Sun, eclipse..... 327
Sun, eclipse of..... *244, 354
Sun, eclipse of the..... *376
Survey, biological, U. S..... 297
Susa, excavations at..... 66, *169
Swamp, the Dismal..... *249
Sweep, aerial..... *260
Switchboard, moving a..... 390
Switchboards, telephone, new..... 87
Switch, oil, pneumatic..... *26
Switching and signaling system..... *136
Swords, Japanese..... 198

T

Targets, movable, German..... 343
Tautener, wire..... *133
Tea, transportation of..... 203
Telegraph at Victoria Nyanza..... 182
Telegraph cable, submarine..... *388
Telegraph, inventor of..... 22
Telegraph lines, Yukon..... 23
Telegraph on Amazons..... 311
Telegraph, Poljak and Virag..... *293
Telegraphy, new system..... 359
Telegraphy, three-wire..... 214
Telegraphy, wireless..... 23, 71
Telephone girls, Viennese..... 251
Telephone switchboard, moving..... 390
Telephone switchboards, new..... 87
Telephone system for farmers..... *196
Telephone system, new..... 119
Telephony, long distance..... *346
Telescope, interesting..... 295
Telephonage system, electric..... 279
Textile manufacture at South..... 322
Thayer, Col., statue of..... *392
Theater effects..... 187
Thermometer, high-pressure..... 391
Thermometers, milligrade..... *170
Threads, cutting..... *196
Three-wire patent, the..... 214
Tie, railway, Chester..... *6
Ties, steel, use of..... 87
Time is money..... 50
Tobacco, poison in..... 119
Tomb of Fulton, new..... 76
Toning with copper ferrocyanid. 179
Tool grinding machine..... *21
Tools, machine, Amer..... 242
Tombs, Etruscan..... *3 9
Torpedo boat, fast trip..... 35
Torpedo cruiser Agordat..... 247
Torpedo destroyer Viper..... *248
Torpedo practice, Newport..... *152
Torpedoes, steering..... 291
Tour du monde, Paris..... *374
Toy, an ingenious..... *229
Traction Congress at Exposition 247
Traction engine, armored..... *388
Traction engines for Siberia..... *276
Traction engines, two large..... 263
Trade marks, foreign..... 170
Trade secret decision..... 360
Trade with Japan..... 86
Trade with South America..... 390
Trade, world's, U. S. in..... 242
Train, armored, French..... 279
Train, experimental..... *356
Train, hospital, African..... *180
Train lighting, electric..... 71, 130
Trains, air resistance..... 354, *356
Trains, armored..... 18
Trains of Siberian railway..... 375
Tramways, the Dresden..... 249
Transformers, large..... 23
Translation, scientific..... 354
Transplanting tool..... *122
Transportation city..... 50
Transportation, history of..... 247
Trans-Siberian Railroad..58, *200, 267
Tree buds, transplanting..... *122
Trees, big, California..... 73, 147, 166
Trees, Christmas..... 71
Trees shattered by lightning..... 167
Trench excavation..... *281
Trinity House, London..... 188
Trolley, automotor..... *219
Trolley rail tester..... *292
Trolley wire hanger..... *244
Trotter, American, abroad..... 338
Trousers clasp, simple..... *22
Try-cock, electric alarm..... *181
Tuberculosis institution..... 167
Tugela bridge..... *115
Tunnel, Blackwall, the..... *217
Tunnel, new, in Paris..... 87
Tunnel, rapid transit..... *69, 194
Tunnel, rapid transit, N. Y..... 322
Tunnel road, London..... 354
Turbines, steam, of Viper..... *248
Turpentine and rosin..... 131
Turquois mines of Persia..... 246
Turret arrangements..... 390
Turret, double, rejected..... 242
Turret, double, system..... 226
Turrets of the Kearsarge..... *230
Turrets, superposed..... 267
Typewriter and the eye..... 198
Typewriter, cheap..... *197
Typewriters, government..... 23

U

United States exhibit, Paris..... *374
United States in world's trade..... 242
Uranium compounds, analysis..... 370
Ur, excavations of..... 214

V

Valve gear, engine..... *276
Valve, steam radiator..... *404
Vans, horse and electric..... 350
Vegetables, Chinese..... 211
Vehicles, motor-wheel..... *11
Veils, acne rosacea from..... 247
Velocipede, mono-rail track..... *298
Vending machine, new..... *378
Venus, rotation of..... 250
Vessel for antarctic explor..... 166
Vessels, hulls, protection..... 327
Vessels, navy models of..... 104
Vessels, propulsion of..... *213
Vessels, raising, acetylene for..... *261
Vesuvius, activity of..... 343
Victorium, new element..... 197
Viper, torpedo destroyer..... *248
Volta School, Naples..... 295
Vulture, California..... *171

W

Wagon, rail, Bonner..... *25
Wagons, armored..... *388
War automobile, prize for..... 230
War, Chinese-Japanese, cost..... 229
War, hypothetical, a..... 212
War, modern, science in..... 227
War, risks of..... 51
Warships, construction of..... 162
Warships, recent, armament..... *41
Waste, use for power..... 114
Water bath, electric..... 119
Water, drinking, Brooklyn..... *404
Water, holy, disease from..... 119
Water raising apparatus..... *122
Water supply, New York's..... 226
Water supply of New York..... 178
Waterway, new inland..... *105
Waterways, carriage across..... 279
Weapon, historic, curious..... *379
Weather map, how made..... *38
Weeding machine, new..... *292
Welsbach burners, lighting..... 361
West Point Academy..... *392
Wharf at Pango Pango..... *139
Whisky in bond, note on..... 198
Wind instruments, theory..... 23
Windmills of Nebraska..... *24
Window blind fastener..... *165
Window guard and fly screen..... *292
Window mirror..... *262
Wine making, new process of..... 92
Wine product of France..... 342
Wire, barbed, as war material..... 87
Wire hanger, simple..... *244
Wire nails, objection to..... 87
Wire stretcher, new..... *133
Women in science..... 98
Wood alcohol, electrolytic..... 324
Wood, injection of..... 51
Wood mosaic..... *341
Woodward, Robert Simpson..... *403
Working drawings, reprod..... *235
Wrench, chain, for pipes..... *87
Wrench of novel form..... *395

X

Xiphopages, the..... *123

Y

Yacht Mineola..... *373
Year 1899, retrospect..... 4
Yew trees, aerial..... 167
Yew trees, curious..... *329
Yukon telegraph lines..... 23
Yukon, the, agriculture..... 27

Z

Zinc plating on iron..... 215
Zinc smelting process..... 355

CAN I BECOME AN ELECTRICIAN?



Yes, you can. We teach **ELECTRICAL ENGINEERING** at your home **by mail** at a cost within the reach of anyone. No matter where you live, if you can read and write, we guarantee to teach you thoroughly. Our Institute is endorsed by **Thomas A. Edison,** and other prominent men of the country. We teach also **Mechanical Engineering, Mechanical Drawing, Telegraphy, Telephony, Electric Railways, Electric Lighting, Electric Mining, Short Popular Electrical Course, Elementary Mathematics,** etc., by mail. *Write for Catalogue.*

The Electrical Engineer Institute of Correspondence Instruction.

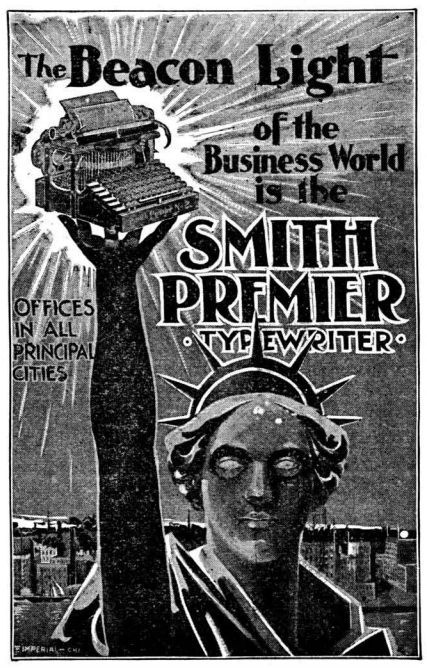
I consider the Electrical Engineer Institute conducted by Messrs Wetzler and Martin to be of great value to those who desire an Electrical education.
Thomas A. Edison

Dept A,
240 West 23d St.,
New York.

LAW TAUGHT BY MAIL

Professional, Elective, Commercial, Law Courses. Guarantees best instruction ever prepared. Indorsed by students and attorneys everywhere. Easy terms. Begin now.

NATIONAL CORRESPONDENCE SCHOOL OF LAW,
38 North Pa. St, Indianapolis, Ind.



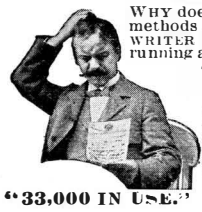
The Smith Premier Typewriter Co.
Syracuse, N. Y., U. S. A.

The Typewriter Exchange



1½ Barclay St., NEW YORK
124 La Salle St., CHICAGO
38 Bromfield St., BOSTON
817 Wyandotte St., KANSAS CITY, MO.
209 North 9th St. ST. LOUIS, MO.
432 Diamond St., PITTSBURGH, PA.
3 West Baltimore St., BALTIMORE, MD.
536 California St., SAN FRANCISCO, CAL.

We will save you from 10 to 50% on Typewriters of all makes. *Send for Catalogue.*

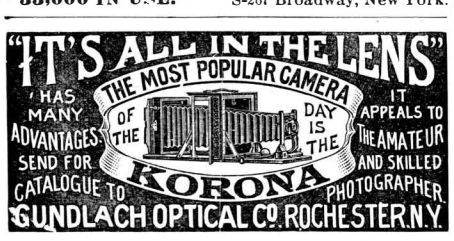


WHY doesn't Jones get down to business methods and buy an AMERICAN TYPEWRITER for $10? Does he think I am running a puzzle department?

THE AMERICAN $10 TYPEWRITER

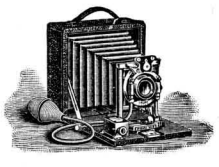
is as well made as the highest-priced machines, but more simple. It has stood the test; seven years without a competitor.
Catalog and sample of work free.
American Typewriter Company,
S-267 Broadway, New York.

"33,000 IN USE."



PREMO CAMERAS

Combine compactness with rigidity, and are made of best materials in every part. The Lens and Shutter are specially designed. They can be secured on no other camera.



Price $10.00 and upwards

ROCHESTER OPTICAL CO.
30 SOUTH STREET,
ROCHESTER, N. Y.



Threshing machine, J. B. Pedrick 652,139
Ticket holder, theater and transportation, G. Hauser 652,107
Tie fastener and expander, Kruger & Crane 651,867
Tile framing, J. White 651,943
Tile, gutter, W. Ludowici 651,873
Time recorder, workman's, C. A. Widmer 651,960
Tire deflater, C. A. Culp 652,232
Tire tightener, S. A. Haseltine 651,855
Tire tightening tool, rubber, C. Waechter, Jr 652,059
Tire, vehicle, H. H. Gerhardt 652,099
Tire, wheel, P. Weinbolt 652,064
Tobacco stemming machine, Schoolfield & Guerrant 652,008
Tobacco stemming machinery, Schoolfield & Guerrant 652,009
Toe clip, J. M. Woodworth 651,913
Tongs, B. I. Davis 652,016
Tool holder, W. J. Cunningham 652,015
Tooth, artificial, Shields & Jernigan 652,047
Toy, L. Berg 652,073
Transformer, S. E. Johannesen 652,027
Trap. See Hog trap.
Trephine, A. De Vilbiss 651,921
Trolley, G. W. Perry 652,039
Trough. See Watering trough.
Tube. See Cycle seat tube. Mucilage tube.
Tube clamp, J. G. Montgomery 652,132
Twine holder, J. E. Fulton 652,235
Typewriter, B. Granville 652,207
Typewriter erasure shield, S. G. Shermer 651,894
Typewriting machine, G. B. Webb 652,063
Uncoupling apparatus, C. A. Tower 652,200
Upholstery, E. G. Newman 651,928
Urinal, C. L. Naumann 652,037
Valve, balanced, H. Lentz 652,029
Valve, check, T. J. Codd 651,964
Valve gear, steam engine, J. B. Kelly 651,863
Valve mechanism for automatic water heaters, J. Gray 652,024
Valve, pressure regulating, E. A. Marsh 651,927
Valve regulating mechanism for engines, J. B. Kelly 652,228
Valve, renewable seat, E. H. Lunken 652,005
Valve, steam cylinder drain, H. W. McCombs, 651,878, 651,879
Valves, making double beat, H. Lentz 652,030
Vapor burner, incandescent, E. Seitz 652,237
Vehicle spring wheel, G. B. Fletcher 652,236
Vehicles, adjustable toe or foot rail for, G. White 652,066
Velocipede driving mechanism, A. F. W. J. Von Wedel 651,941
Vessel, freight, A. Wallace, Jr 652,061
Vise, multiple, E. Q. Olson 651,929
Voting machine, L. W. Luellen 651,874
Wagon and surf boat, combined beach, J. A. Howell 652,184
Washboard, A. W. Bischoff 651,818
Washer. See Bottle washer.
Water clarifying apparatus, W. M. Deutsch 651,835
Water elevator or irrigating apparatus, H. Room 652,143
Water heater, H. F. Gabel 652,176
Water, purifying, C. L. Deutsch 651,834
Water purifying apparatus, T. R. Wingrove 652,155
Water tight bag, flexible, C. T. Bradshaw 651,819
Watering trough, J. J. McCarthy 651,877
Web feeding device, H. H. Jacobus 652,114
Weeder, lawn, A. Burson 652,077
Weighing machine, E. W. Collins 652,087
Well drilling machine, hand, G. D. Loomis 652,004
Wheel. See Fifth wheel. Metal wheel. Vehicle spring wheel.
Whiffletree trace fastener, C. L. Cambern 651,824
Window, J. A. Knisely 652,120
Window casement and casement frame, J. W. Mosely 652,216
Wire stretcher, F. M. Russell 651,890
Wire stretcher and reel carrier, C. Stoolfire 651,897
Wireworking tool, C. Stoolfire 651,896
Wood, producing artificial, A. Skrobanek 652,144
Writing apparatus, multiplex, C. Tschinkel 651,903

DESIGNS.

Auger, post hole, J. Mann 32,852
Badge, D. C. Fauss 32,845
Bath tub, F. A. Wells 32,858, 32,859
Belt or similar article, E. Orayeh 32,863
Carpet, oriental, H. Sarafian 32,864 to 32,866
Curtain or shade bracket, S. G. Wilkerson 32,851
Ewer or jug, D. F. Haynes 32,848
Fork blade, fodder, R. Teegardin 32,853
Handle bar post, E. B. Weed 32,856
Knife, orange, A. B. Casselman 32,846
Lamp bracket member, F. M. Rosenbluth 32,850
Lavatory base, W. C. Peet 32,857
Musical instrument body, H. Faber 32,849
Plate, S. G. Reynolds 32,847
Sewing machine frame, R. Pierpont 32,860
Spade or shovel, P. P. McClintock 32,854
Spool stand, C. A. Poinsett 32,862
Table or stand, center, J. Benesh 32,861
Tire valve cap, G. H. F. Schrader 32,855

TRADE MARKS.

Abrasive stones and articles, Norton Emery Wheel Company 34,807
Boots and shoes, S. C. Lauber 34,793
Boots, shoes, and slippers, women's, misses', and children's, Faunce & Spinney 34,795
Braces, trusses, and bandages, Natural Body Brace Company 34,796
Chocolate bonbons, H. D. Foss & Company 34,799
Clothing, certain named articles of, Hammond & Company 34,792
Gin, G. S. Nicholas 34,801
Lamp chimneys, Friedlaender & Oliven 34,800
Machinery, tools, and supplies, certain named, Miller, Du Brul & Peters Manufacturing Company 34,804
Registering machines, A. F. Bardwell 34,805
Salve, healing, Hess & Son 34,797
Scientific and philosophical apparatus, certain named, T. A. Edison 34,806
Sewing machines, stands, and attachments, National Sewing Machine Company 34,803
Shoes, J. G. Simon 34,794
Soaps and soap powders, White & Bagley Company 34,798
Torpedoes, L. J. Morse 34,808
Wood finish, Cleveland Varnish Company 34,802

LABELS.

"Aqua Lithia," for a beverage. Artesian Manufacturing and Bottling Company 7,657
"Caracus Coffee," for coffee, Dayton Spice Mills Company 7,651
"Dr. Pepper's Phos-Ferrates," for a beverage, Artesian Manufacturing and Bottling Company 7,656
"Edison Records," for phonograph records, National Phonograph Company 7,648
"Genuine Edison Record," for phonograph records, National Phonograph Company 7,649
"Hahn's Sure Cure for Hog and Poultry Cholera," for a medicine, M. Hann 7,659
"Jersey Baking Powder," for baking powder, Dayton Spice Mills Company 7,653
"Jersey Roasted Coffee," for roasted coffee, Dayton Spice Mills Company 7,650
"Kopp's Dead Shot," for an insecticide, J. D. Kopp 7,658
"La Fuma Que Agrada," for cigars, American Label Company 7,654
"Lehigh University Special Blend Whisky," for whisky, L. McCormick 7,655
"Old Virginia Baking Powder," for baking powder, Dayton Spice Mills Company 7,652
"Old Wyandotte's Remedy," for a medicine, C. C. Sykes 7,661
"Vitone," for a medicine, E. S. Burnham 7,660

PRINTS.

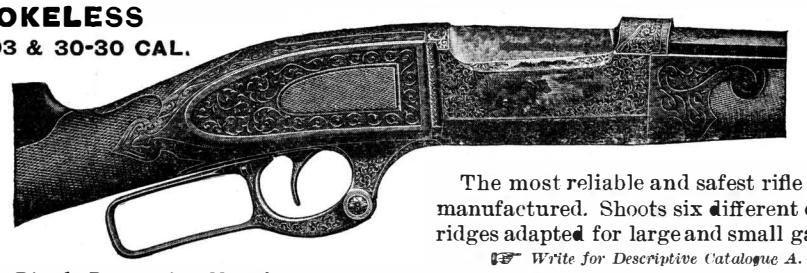
"Congress Playing Cards," for playing cards, United States Playing Card Company 238
"Duplex Bonne Femme," for window drapery, Cohen Brothers & Company 239

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York. Special rates will be given where a large number of copies are desired at one time.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. **Other foreign patents may also be obtained.**

SAVAGE Hammerless Magazine Rifle

SMOKELESS .303 & 30-30 CAL.



The most reliable and safest rifle ever manufactured. Shoots six different cartridges adapted for large and small game.
Write for Descriptive Catalogue A.

Point Blank Range for Hunting.
The Only Hammerless Repeating Rifle.

SAVAGE ARMS CO.
UTICA, NEW YORK, U. S. A.

50 YEARS' EXPERIENCE

PATENTS

TRADE MARKS
DESIGNS
COPYRIGHTS &c.

Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents.

Patents taken through Munn & Co. receive *special notice*, without charge, in the

Scientific American.

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.

MUNN & Co. 361 Broadway, **New York**
Branch Office, 625 F St., Washington, D. C.

MEDIUM-SIZED AUTOMATIC
or similar machinery built to order. Our facilities and experience in this line are exceptionally advantageous. We invite correspondence from inventors of mechanical devices. O'TT. MERGENTHALER COMPANY, Incorporated, Baltimore, Md.

PROPOSALS.

SEALED PROPOSALS WILL BE RECEIVED AT the office of the Light-House Engineer until 12 o'clock M., July 7, 1900, and then opened, for furnishing the material and labor of all kinds necessary for the delivery, erection and completion of the Hog Island Shoal Light-House, R. I., in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to D. P. HEAP, Lieutenant-Colonel, Corps of Engineers, U.S.A.

ICE MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton Street, Milwaukee, Wis.

STEEL TYPEWRITER TYPE
TYPE WHEELS. MODELS & EXPERIMENTAL WORK. SMALL MACHINERY NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST. N.Y.

INVENTIONS PERFECTED.
Accurate Model and Tool Work. Write for Circular.
PARSELL & WEED. 129-131 West 31st St., New York.

$75 Month and Expenses; no experience needed; position permanent; self-seller, PEASE MFG. CO., Stat'n 10, Cincinnati, O.

D'AMOUR & LITTLEDALE MACHINE CO.
130 WORTH ST. NEW YORK.
Make Models of Any Machine to Order.

Experienced Draught-man wanted on Mill Machinery and Machine Tools. Permanent employment assured to rapid and accurate draughtsman. Bethlehem Steel Co., South Bethlehem, Penn.

Are You Going to Build a Home?



Those intending to build will find the very best practical suggestions and examples of Modern Architecture in the handsomest Architectural Magazine ever published,

"The Scientific American Building Edition."

Each number is illustrated with a *Colored* plate and numerous handsome engravings made *direct from photographs of buildings*, together with interior views, floor plans, description, cost, location, owners' and architects' names and addresses. The illustrations include seashore, Southern, Colonial and City residences, churches, schools, public buildings, stables, carriage houses, etc.

All who contemplate building, or improving homes or structures of any kind, have in this handsome work an almost endless series of the latest and best examples from which to make selections, thus saving time and money.

PUBLISHED MONTHLY. SUBSCRIPTIONS, $2.50 A YEAR. SINGLE COPIES, 25 CENTS.
For sale at all news stands, or address **MUNN & CO., Publishers, 361 Broadway, New York.**

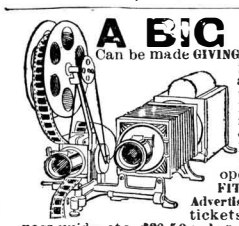
AGENCIES WANTED FOR ENGLAND.
A firm of Importers and Exporters (also Government Contractors) are open to handle American Manufactures of every description as Sole European Selling Agents. Manufacturers desirous of being represented in the United Kingdom, or opening up a branch, will kindly mail lists, samples, etc., giving full particulars (to save needless correspondence) of prices, etc., and say what they are prepared to do to push business. F. WINTERHOFF & CO., Limited, Lithographic Stone Quarry Owners and General Merchants, 58c Gray's Inn Road, London, W. C., England. N. B.—Correspondents will much oblige by seeing that all letters, lists, etc., mailed, have sufficient postage prepaid.

ONE CENT invested in a postal card and mailed to us will bring you a "**Gem**" **Safety** Razor outfit for your trial. Keep the outfit 10 days, and if you are not satisfied return it. Please forward references from responsible parties.



The Gem Cutlery Co., 35 Reade St., N. Y.

A BIG INCOME
Can be made GIVING PUBLIC ENTERTAINMENTS in Churches, Halls, and Theatres with MOTION PICTURES the new Grapho-Amplifone, MUSICAL and Talking Combination and Panoramic Stereopticon Views. $60 to $300 PER WEEK. Pleasant employment and any man can operate them. COMPLETE OUTFITS, including large illustrated Advertising Bills (18x24), admission tickets, instruction book, business guide, etc., $39.50 and up. Most interesting and sensational subjects, just out. Will be sent C.O.D. subject to examination. Write for catalogue and copies of letters from exhibitors who are MAKING BIG MONEY with our outfits.
ENTERTAINMENT SUPPLY CO. Dept. AA. 56-58 5th Ave. CHICAGO



Brass Band
Instruments, Drums, Uniforms, & Supplies. Write for catalog, 445 illustrations, FREE; it gives information for musicians and new bands. LYON & HEALY,
88 Adams St., CHICAGO.



"Hawkins' New 1900 Catechism"
OF THE STEAM ENGINE.
PRICE, $2.00.



Postpaid to any address. A practical book on engine running, valve setting, etc. Strictly up-to-date. Money refunded if not satisfactory.
THEO. AUDEL CO., 63 Fifth Ave., New York City.

TURBINES Send for Circular "M." JAS. LEFFEL & CO. Springfield, Ohio, U. S. A.

PATENT No. 621,997, HAND STAMP HANDLE, FOR SALE. Address G. W. DUNCKLEE, Box 364, Brockton, Mass.

A PATENTED SPECIALTY will be purchased outright or manufactured on royalty. References given if required. T. S. F., Box 773, New York City.

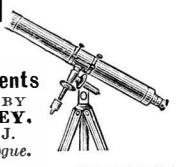
MODELS & EXPERIMENTAL WORK. Inventions developed. Special Machinery.
E. V. BAILLARD, Fox Bldg., Franklin Square, New York.

For Sale—Tablet Machine, in first-class condition. Used little. Manufactured by R. Shoemaker. Size 3/6 inch, can be adjusted to 9-16 inch. Cheap for cash. Address **Box No. 283, Racine, Wis.**

D. L. HOLDEN
1336 BEACH ST. PHILADELPHIA PA.
SOLE MANUFACTURER
REGEALED ICE MACHINES
SEE FIRST PAGE SCIENTIFIC AMERICAN SEPT. 2. 1899.



Astronomical AND Engineering Instruments
MANUFACTURED BY
W. & D. MOGEY,
Bayonne City, N. J.
Send for Catalogue.



PHOTOGRAPHY AT WIDE RANGE

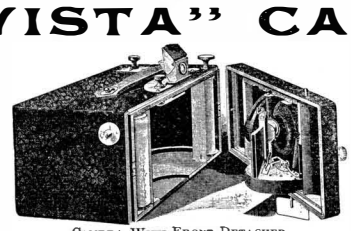
You can take in the full length and breadth of Nature's beauty, marine or landscape, city or country, at almost any desired elevation, and by the simple turning of a button, if you use the

"AL-VISTA" CAMERA.

LONG AND SHORT PICTURES.

CAMERA HAS UNIVERSAL FOCUS.

LEVEL ATTACHED.



CAMERA WITH FRONT DETACHED.

DETACHABLE HANDLE.

FITTED WITH UNIVERSAL TRIPOD SOCKET.

MOROCCO LEATHER COVERED CASE.

A nickeled trimmed and beautifully finished Camera of great power and scope. A perfect instrument that fills a long felt want in the photographer's outfit. For sample prints taken with the "AL-VISTA" on a fine bevel edge card, send 24 cents in stamps to cover postage, to the

MULTISCOPE AND FILM COMPANY, BURLINGTON, WIS., U. S. A.

FOR MEN OF BRAINS

Cortez CIGARS

-MADE AT KEY WEST-

These Cigars are manufactured under the most favorable climatic conditions and from the mildest blends of Havana tobacco. If we had to pay the imported cigar tax our brands would cost double the money. Send for booklet and particulars.

CORTEZ CIGAR CO., KEY WEST.

THOROUGH INSPECTIONS

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

AND INSURANCE AGAINST LOSS OR DAMAGE TO PROPERTY AND LOSS OF LIFE AND INJURY TO PERSONS CAUSED BY

STEAM BOILER EXPLOSIONS

J. M. ALLEN, PRESIDENT — W. B. FRANKLIN, VICE PRESIDENT
J. B. PIERCE, SECRETARY — F. B. ALLEN, 2D VICE PRESIDENT
L. B. BRAINERD, TREAS. — L. F. MIDDLEBROOK, ASST SEC'Y

IT'S CHEAPER THAN A HORSE.



There is no feeding, no stabling, no groom, no driver, no veterinary surgeon, no other expense needed for a

WINTON MOTOR CARRIAGE

You can operate it yourself and regulate the speed at will. No dirt, no danger, no "bolting," no sickness. It costs only when in use. Try one. Hydro-carbon system.

Price $1,200. No Agents.

THE WINTON MOTOR CARRIAGE CO., Cleveland, Ohio.
Eastern Department, 120 Broadway, New York City.

Automobile Patents Exploitation Company.

UNDERTAKES:—The manufacture of Automobiles and Motor-Cycles. The examination of Automobile patents. To enlist capital for the development of inventions.

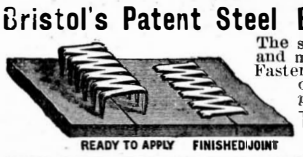
FURNISHES:—Specialists to make thorough examinations of patents. Experts to test motors and automobiles. Opportunities to inventors to present properly their propositions to concerns willing to consider and to undertake the same.

PURCHASES:—All meritorious patents, licenses and inventions relating to motor-cycles, motors, gears, automobiles and their parts.

Automobile Patents Exploitation Company,
F. B. Hyde, Secretary.
27 William Street, New York, N. Y.

RUST ON GUNS TOOLS & CYCLES **PREVENTED** BY **MANNOCITIN**
C. H. BESLY & CO. CHICAGO ILL. U.S.A.

Bristol's Patent Steel Belt Lacing.



The simplest, cheapest and most perfect Belt Fastening for all kinds of belting. *Samples sent free.*
The Bristol Co.
Waterbury Conn.

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Sates Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE CO., Chicago, Ill.

WOODS MOTOR VEHICLE CO.

ANY STABLE—

private or public—can be equipped at short notice with the latest design, modern Electric Automobile, if you write or call on us.

The Woods is handsome in appearance, durable in construction, ready, reliable and safe.

Illustrated booklet free.

WOODS MOTOR VEHICLE COMPANY

N. Y., 44th St. & Vanderbilt Av.
Chicago, 545-549 Wabash Av.

"They are ready for you when you are ready for them."



"ROAD WAGON."

ELECTRIC AUTOMOBILES, their care, construction and operation, an indispensable book published by HERBERT S. STONE & Co., Chicago, Ill., **$1.25.**

ASBESTOS FIRE-FELT COVERINGS

PURE ASBESTOS — ABSOLUTELY FIRE PROOF.
REPLETE WITH AIR CELLS — PERFECT NON-CONDUCTORS.
STRONG, LIGHT, FLEXIBLE — EASILY APPLIED.
MADE IN SECTIONS — THREE FEET LONG.
FIT STANDARD PIPE — ½ INCH TO 16 INCHES.

H. W. JOHNS MFG CO.
NEW YORK · CHICAGO · PHILADELPHIA · BOSTON ·
MAKERS OF
ASBESTOS MATERIALS. — LIQUID PAINTS & STAINS.
ROOFING MATERIALS. — ELECTRICAL MATERIALS.

Dainty Watches



in colored enamels to match dress effects.

Send for our "Blue Book"—free.

THE NEW ENGLAND WATCH CO.
37 Maiden Lane, New York — 149 State Street, Chicago



HAVE YOUR CYCLE FITTED WITH THE MORROW COASTER -HUB BRAKE

WITH THIS BRAKE YOU RIDE 50 MILES BUT PEDAL ONLY 35.

OVER 100,000 IN USE.

EASILY PUT ON. HAS PROVED PERFECT AND RELIABLE. FULLY GUARANTEED.

Coasting becomes so safe and easy you do it every chance you get. Your feet on the pedals gives perfect control of the wheel. Ladies' skirts keep down when coasting. You can adjust it to any make of cycle.

Our **Acetylene Bicycle Lamp** is superior in construction to any made.

Illustrated pamphlet giving detailed information regarding Brake and Lamp, sent on application.

ECLIPSE BICYCLE CO.
Box X, ELMIRA, N. Y.

SENT ON TRIAL.
Prepaid to any address.



Coggeshall Patent Steam Tube Cleaner.

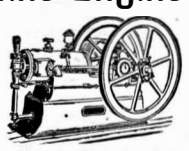
THE CLEANER THAT CLEANS CLEAN

NO Moisture, Saves cost quickly. A trial costs
Scale. Cleans from end to end. you nothing

The Coggeshall Mfg. Co., 123 Liberty St., New York.

CHARTER Gasoline Engine

USED ANY PLACE BY ANYONE FOR ANY PURPOSE



Stationaries. Portables, Engines and Pumps.

☞ State your Power Needs.

CHARTER GAS ENGINE CO., Box 148, STERLING, ILL.

TEN-YEAR TEST.

The following letter from one of the largest cement manufacturers in the world proves positively the marked superiority of **THE GRIFFIN MILL** for pulverizing either rock or cement clinker.

AMERICAN CEMENT COMPANY,
OWNERS OF
The Egypt Portland Cement Works. *The Pennsylvania Portland Cement Works.* *The Columbian Portland Cement Works.* *The Giant Portland Cement Works.* *The Jordan, N. Y., Portland Cement Works.*

Messrs. BRADLEY PULVERIZER CO. EGYPT, PENN., August 25, 1899.

Gentlemen: Replying to your inquiry as to what we think of **THE GRIFFIN MILL**, we will say that the first Griffin Mill used in grinding Portland cement was erected in our Egypt works ten years ago, where it is still in operation. Since then, as from time to time we have built new works, we have equipped them all with Griffin Mills. We have now in operation at our several works, thirty-seven mills.

We know all about the grinding machinery used in the various cement works in this country, but think the Griffin Mill superior to any other for grinding Portland cement and the raw material from which it is made. What we think of the Griffin Mill is shown by the fact that within the last week we have given you an additional order for more mills.

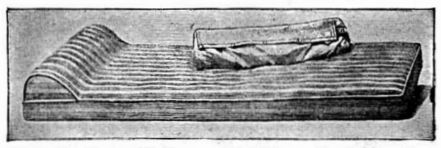
Yours very truly, AMERICAN CEMENT CO.,
JOHN W. ECKERT, President.

The demonstrated success of the GRIFFIN MILL for pulverizing all refractory substances allows us to sell them on their established record. Write us for names of manufacturers who are daily using them with perfect satisfaction.

THE BRADLEY PULVERIZER CO., = = Boston, Mass.

RESTFUL SLEEP
In Camp, on the Yacht and at Home.

"Perfection" Air Mattresses,
CUSHIONS and PILLOWS.



Style 61. Camp Mattress with Pillow attached. Also showing Mattress deflated.

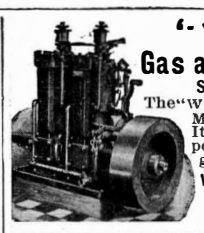
Clean and Odorless, will not absorb moisture.
Can be packed in small space when not in use.

☞ *Send for Illustrated Catalogue.*

MECHANICAL FABRIC CO., PROVIDENCE, R. I.

ACETYLENE BURNERS.

We have the largest and best equipped factory in the world for making genuine steatite Acetylene Gas burners. Correct scientific principle. Quality and workmanship guaranteed.
STATE LINE TALC CO., Chattanooga, Tenn., U. S. A.

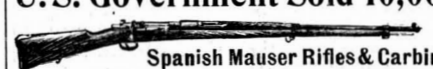


"WOLVERINE" Gas and Gasoline Engines
STATIONARY and MARINE.

The "Wolverine" is the only reversible Marine Gas Engine on the market. It is the lightest engine for its power. Requires no licensed engineer. *Absolutely safe.* Mfd. by

WOLVERINE MOTOR WORKS,
12 Huron Street,
Grand Rapids, Mich.

U.S. Government Sold 10,000



Spanish Mauser Rifles & Carbines

also 5,000,000 Ball Cartridges in clips. **We bought them all.** Before exporting them, we offer a limited number at retail.
F. BANNERMAN, 577 Broadway, New York.
Catalog on request. Dealer in Military Goods and War Relics.

ELECTRICAL MACHINERY BARGAINS
ARC LAMPS. ALL KINDS AND SIZES
OF DYNAMOS, ENGINES, MOTORS ETC.
CORRESPOND WITH US TO BUY OR SELL.
THOMPSON SON & Co. 105 LIBERTY ST. N. Y.



You will not get left

If you Own One of the Reliable

"Accurate-to-the-Second"

DUEBER-HAMPDEN WATCHES

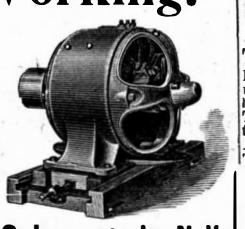
LOOK FOR THE NAME "DUEBER" IN CASE
"John Hancock" 21 Jewels. For Gentlemen.
"Special Railway" 23 Jewels. For Railway Men.
"The 400" For Ladies.
Our "Guide to Watch Buyers" Sent Free.
The Dueber-Hampden Watch Works, - Canton, O.

"Costs Nothing When Not Working."

You can insure good and quick work in your shop if you are supplied with one of our

"G E" SMALL MOTORS.

Run from lighting circuit. 110 volts. Expense stops when they stop.



GENERAL ELECTRIC CO. Main Office, Schenectady, N. Y.

THE BICYCLE: ITS INFLUENCE IN Health and Disease.—By G. M. Hammond, M.D. A valuable and interesting paper in which the subject is exhaustively treated from the following standpoints: 1. The use of the cycle by persons in health. 2. The use of the cycle by persons diseased. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1002. Price 10 cents. To be had at this office and from all newsdealers.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC.
WM JESSOP & SONS LD 91 JOHN ST. NEW YORK